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Analysis of SHORT-TIME CHANGES IN THE PRICE OF BUTTER at Chicago

Marketing Research Report No. 194

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Marketing Service
Marketing Research Division
Washington, D. C.

PREFACE

At present there are surpluses of dairy products. Prices rest on Commodity Credit Corporation support levels, and fluctuations in butter prices are not a problem. But in the past we have sometimes moved rapidly from conditions of surplus to shortage. The findings of this report will be available for use at such times as prices in butter markets are above established support levels and are determined by free market forces.

Certain of the findings are not limited to the butter market, but have broader application to the general problem of price instability and to the technique of short-time price analysis.

The report does more than analyze fluctuations in butter prices. It tells how well price serves its function of equating butter supply and demand. It explains how the butter marketing system operates, providing an understanding which may be the basis for improving the system. It furnishes management with information which can be used to make the price system more efficient. It also demonstrates how strongly the fluctuations of price influence marketing margins and shows that margins may bear no basic or direct relationship to the cost of marketing services for prolonged periods.

This report is part of a broader study of the establishment of prices of manufactured dairy products in central markets. It supplements a report issued by the U. S. Department of Agriculture in 1953 entitled, "The Establishment of Central Market Butter Prices at Chicago and New York," Marketing Research Report No. 53. This report is available in some libraries. The earlier report dealt with the manner in which prices are established, the nature of the buying and selling transactions upon which prices are based, the manner in which the forces of supply and demand are brought to focus, and the means by which the price establishing process might be improved. It is suggested that, if possible, the previous report be read before reading this report.

August 1957

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Washington 25, D. C. - Price 10 cents

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SUMMARY AND CONCLUSIONS

Since World War II the price of butter has tended to fluctuate erratically when it was not being actively supported by Government purchases.

It was found in this study that, in general, relatively little of the day-to-day changes in price could be associated with published indicators of short-time changes in supply and demand. Despite the failure to find strong measurable relationships between daily prices and other market statistics, major receivers of butter and others familiar with the market say that the butter market is very sensitive to changing supply and demand situations. Close observation of major price movements indicated that this was true, but that price adjustments were excessive and undependable relative to changes in supply and demand, particularly when supplies were short.

This study examined the nature of fluctuations in butter prices at Chicago during 1947, 1948, 1951, and January through March 1952. The fluctuations were evaluated as to their reasonableness in terms of short-time changes in supply and demand, and the extent to which short-time changes in price could be explained by changes in supply and demand factors was determined statistically. The relationship between price and 20 supply-demand factors was studied for 10 marketing seasons encompassing 811 trading days, and detailed qualitative analysis was made of factors affecting price during certain periods in which price was consistently moving in one direction.

During certain periods changes in supply-demand factors explained statistically over 50 percent of short-time changes in butter prices, but during other periods only a small part of the changes in price could be associated statistically with changes in supply and demand.

The statistical techniques used in this study have been useful in other price studies, but they may not be adequate for expressing the complexities of day-to-day events in the market place. The results, therefore, do not warrant the inference that the market reporter is incorrect when he reports a close relationship between short-time changes in supply and demand and price, or that the market is not responsive to what the trade feels supply-demand conditions to be.

Several findings resulting from the statistical analysis are significant:

1. Changes in dealers' floor stocks of butter were consistently associated with a considerable part of the daily and weekly changes in the price of butter. This factor, more so than any other, was associated with these changes, particularly during the in-storage season when other influences explained very little of the change. This would indicate that information about changes in dealers' floor stocks is important market information and might well be published by the United States Department of Agriculture Market News Service on a daily basis, rather than weekly. Changes in production explained a relatively large amount of the change in the price of butter at times during the out-of-storage seasons but very little during the in-storage seasons.

2. Less of the change in butter prices could be explained statistically during the in-storage period when production was heavy and price relatively stable than during other parts of the marketing year. Changes in price were most fully explained during the fall out-of-storage season. During 1947 and 1951, the combination of receipts, dealers' floor stocks, trade output (production adjusted for change in storage holdings), annual rate of butter production, and storage holdings in the 35 markets explained about one-half of the variation in weekly prices during the fall out-of-storage season.

3. A considerably greater part of week-to-week price changes than day-to-day changes could be explained statistically. This may indicate that many of the responses involved are not instantaneous but cumulative. It also is indicative of the difficulty of appraising the significance of day-to-day changes in various measures of supply and demand. It also might be evidence of the difficulty of measuring the relation between supply-demand information published weekly and day-to-day price decisions.

4. Published information as to supply and demand which was available only weekly explained no more variation in price on the day of release than on subsequent days of the week.

5. Butter prices were not significantly different on different days of the week. There was no indication that prices tended to decline early in the week when receipts were generally heavier, or that prices increased later in the week when receipts were generally lighter and movement into distributive channels heavier.

6. Daily changes in the price of butter at Chicago were generally highly correlated with changes at New York. Changes at New York were closely associated with changes at Chicago, though to a somewhat lesser extent.

During the period studied there were distinct intervals or phases during which prices moved consistently in one direction or the other. Often the beginning of a price phase was associated closely with the beginning or end of the storage season. The direction of movement was generally consistent with evident supply conditions, but adjustments were often excessive.

Maladjustments between the New York and Chicago markets were particularly frequent during 1947 and 1948. Fluctuations in the Chicago market were intensified by fluctuations at New York, where historically butter prices have been more variable than at Chicago.

Butter prices tend to be unstable because of the nature of the product and the manner in which it is marketed. Particularly important is the sometimes erratic pattern of production from week to week and the tendency for both supply and demand to be inelastic within short periods, under certain conditions.

Short-time fluctuations of butter prices might be reduced by limiting the range of prices at which butter could be sold, bid for, or offered on the exchanges on a given day.

ANALYSIS OF SHORT-TIME CHANGES IN THE PRICE OF BUTTER AT CHICAGO

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INTRODUCTION

This study deals with day-to-day fluctuations in the price of butter.

Persons in the dairy industry, producers, government officials, and students of marketing have been concerned with the tendency of butter prices to fluctuate severely at times. Such changes were particularly common during 1946, 1947, and 1948, but have been a matter of concern at various other times. In 1948, a committee made up of representatives of butter dealers, producer groups, and a representative from a State university issued a statement directed to the New York and Chicago mercantile exchanges deploring the frequent and large changes in daily butter prices (3, p. 56). 1/

Short-time price fluctuations frequently have caused alarm in many commodity markets. Many times sharp market fluctuations have resulted in charges that the market was being manipulated (6, p. 4).

Butter price quotations are used widely in the dairy industry, both by those who buy or sell butter and by others. Butter prices historically have provided the basis for establishing producer prices for fluid milk and cream in many parts of the country and for pricing surplus milk in fluid milksheds. Producers have been paid for farm-separated cream on the basis of central market butter prices. The fact that so many people other than those who actually buy or sell butter have a direct financial interest in the price of butter, a price which they take only a very remote part in establishing, is reason in itself for a widespread critical interest in the market.

Certain features of the system by which butter prices are established from day to day have tended to undermine confidence in it and have probably been responsible in part for the persistent concern over the day-to-day fluctuations of these prices. Principal criticisms have been that (1) prices are established on the basis of limited trading on the Chicago and New York mercantile exchanges, (2) many large buyers and sellers take no direct part day to day in establishing prices, (3) certain rules of the exchanges restrict participation in the establishment of prices, and (4) premiums over the quotation are frequently paid to creameries and in the open market. In a previous study it was concluded that these criticisms have some validity, but that their importance may be exaggerated (3).

1/ Underscored numbers in parentheses refer to Literature Cited, p. 67.

Objectives

The objectives of this study were:

1. To examine the characteristics of short-time fluctuations in spot butter prices.

2. To determine the factors which influence daily butter prices.

3. To measure the extent to which short-time changes in spot butter prices may be explained by short-time changes in the supply and demand for butter, and, conversely, the extent to which short-time changes appear to be random or unexplained.

4. To determine what additional market information, if any, would be helpful to those active in price establishment in ascertaining short-time changes in supply-demand conditions.

Approach Used

The degree to which short-time changes in price are associated with short-time changes in supply of and demand for butter provides some basis for appraising the pricing system. If price changes are associated with short-time changes in supply and demand, it gives additional credence to the general attitude expressed by butter receivers as to the effectiveness of the pricing system. Although, since extremely erratic patterns of price have existed at times, the question may still be raised as to whether there are factors affecting supply of and demand for butter in the short run that tend to make the butter market inherently unstable. If responses seem unreasonable in light of actual changes in supply and demand, questions may be raised as to (1) the effectiveness of the present system of establishing values and (2) whether, because of the nature of the product and the manner in which it is marketed, factors exist which tend to make daily butter prices inherently unstable.

Multiple correlation analysis was used in an attempt to measure the extent to which short-time changes in price can be explained by short-time changes in a number of factors reflective of changes in the supply of and demand for butter.

This is a widely used method, but it does not represent or measure the effects of all of the factors which influence the establishment of the daily price of butter or other commodities. There are considerable difficulties in relating the results of statistical manipulation to the dynamic complex of variables which is the market.

The formal statistical approach was supplemented by qualitative observation of the market at selected times under specified conditions. These observations were used to appraise the reasonableness of price responses. The two approaches complement one another. Each has deficiencies but together they give a picture of price-making processes not previously available.

NATURE AND CHARACTERISTICS OF SHORT-TIME PRICE FLUCTUATIONS

Short-time price fluctuations seem to be characteristic of competitive markets, whereas in markets in which a few firms have a high degree of control prices tend to be more stable. Control of supply is an important element in price stability. If supply is not controlled, the degree of price instability may depend on the natural steadiness of supply and demand and on the strength and timeliness of the price responses to short-time changes in supply or demand. Steadiness of supply and demand, in turn, depends upon numerous factors, including the commodity's production pattern, whether it is perishable or not, the nature of demand for the commodity, the accuracy and timeliness of market information, existence of substitutes, institutional arrangements under which the product is bought and sold, and the number and type of firms engaged in its production and distribution. Strength of short-time price responses depends also upon numerous factors, including the extent to which supply and demand are affected by changes in price, that is, the elasticity of supply and demand, the market situation at a particular time, the nature, experience, and temperament of the traders, the nature of firms in the market, and the degree of competitiveness of the market.

"Price Discovery" 2/ in the Butter Market

Price is based on the willingness of sellers to sell and buyers to buy. Such willingness is based on the judgment of various individuals in the market, some with the same interests, and others with interests that are directly opposite. "The market" is nebulous and ever-changing (7, p. 395).

On a particular day it is not uncommon to find products of identical quality in a wholesale market selling at prices which range substantially. Even greater ranges exist when the prices for various grades of the product are considered. The same dealer may sell the same product to different customers at different prices depending on many factors, such as whether the customer is a regular customer, the size of the order, and the dealer's feeling as to market conditions at the particular time of day the sale is made.

2/ It is important to distinguish between the process of price discovery by which traders gain insight as to what the "price" is and actual price-making forces. Foote and Thomsen (8) point out: "People can easily observe portions of the market mechanism for price discovery such as the dickering of packer buyers and commission house salesmen in the terminal livestock markets, and draw erroneous conclusions. Frequently such observations give no insight whatever into actual price-making forces."

Market reporters often report a price range when reporting a market price for a commodity; in addition to reporting the range, they may report a "mostly price," or they may quote a single price which they think is representative of the market even though they are aware that sales are being made at a range of prices.

Some of the differences in price reflect differences in market opinion; others, differences in services rendered, quality, and other factors. The latter may confuse the problem of what the price is, but it is market opinion that is basic to price determination.

Trading in spot butter on the mercantile exchange is conducted under rules which specify in detail matters such as quality, services provided, size of sale, and type of package. These rules eliminate most of the problems of price determination which are associated with factors other than judgment of the market. The exchange provides facilities for the reconciliation of different judgments, permitting a much more rapid adjustment of the market than occurs during the normal course of trading in an unorganized market.

For butter, the quotation established for the day on the basis of trading on the mercantile exchange provides, directly or indirectly, the basis on which most of the butter in the country is bought and sold at the creamery, wholesale, and jobber levels. Changes in the butter quotation generally are very quickly reflected at the retail level.

Present at the trading sessions are individuals who, because of their particular trading position would like to see the market go up, others who would like to see it go down, and still others who are satisfied with existing values. At times the sentiment may be very strong that values should increase or decrease or that the market is at proper levels. At other times because of the market situation and the trading position of those involved, the sentiment is very diverse.

Nature of Trading

Observation of the nature of trading on the spot butter boards and on the open market and consideration of decisions faced by those who trade on the market provide an insight as to how the process of "price discovery" works.

With the vast majority of the buying and selling transactions based on a predetermined differential relative to the quotation, the number of transactions in which butter is sold on other than a fixed basis are small (3, pp. 30-32). The transactions which provide the basis for price discovery are mainly transactions between dealers who are attempting to balance supplies with commitments or anticipated needs. They are transactions in bulk butter between dealers who are willing to sell uncommitted supplies and those who are willing to buy them.

It is on the open market and at the spot butter boards of the mercantile exchanges that this willingness to buy or to sell uncommitted supplies is expressed and price determined. The judgment of others throughout the marketing system as to price is indirectly expressed or brought into focus at these points.

Price as the Mechanism for Balancing Supply and Demand

Through the mechanism of price is sought the means of moving varying seasonal and daily receipts of butter into the channels of consumption or storage in an orderly manner. If it were possible to know in advance exactly what supply and demand would be, a pricing system could be visualized which would maintain an orderly and constant flow of butter to consumers with only necessary seasonal fluctuations. Such a system would keep the price at levels that would move exactly the required amounts of butter into storage. As a result, supply would be kept in balance with demand. It is this level that the market is always seeking, but because of uncertainty of supply and demand such perfect adjustment is seldom reached.

At times, for periods as long as several weeks the butter market has seemed to approach this ideal. With a minimum of fluctuation in price, supplies have moved into consumption and into storage in an orderly manner; a temporary state of equilibrium has existed with virtually no change in price or with orderly, gradual changes in price which were generally accepted. Those who needed butter for distribution were able to buy what they needed, and those who desired to accumulate stocks of storage butter likewise found such butter available in approximately desired quantities. A general willingness to buy and to sell existed. Such periods were characterized by relatively less trading on the mercantile exchange (3, p. 55).

When movement ceased to be orderly, supplies began to back up, or dealers found it impossible to obtain necessary supplies, at the existing price level, then the spot board of the mercantile exchange became active. Efforts were made by traders to ascertain how much price must be lowered before surpluses could be moved or how much the price must be raised before those who held supplies would be willing to sell them.

At times the orderly marketing of butter seems to have been disrupted because of short-time changes in market sentiment. For example, receivers on a weak market may have attempted to quickly reduce their floor stocks or other holdings with a view to replacing them shortly with less costly butter; thus they have induced further weakness. The existence of a market in which day-to-day declines have sometimes been large provides the incentive for such actions. The knowledge that butter prices have changed sharply within a short time creates uneasiness. When the market has advanced to the point that dealers and even retailers feel there is more chance of a decline than not, they may curtail purchases and buy supplies daily rather than less frequently. This disrupts orderly marketing and makes demand difficult to ascertain.

Sharp short-time changes in price create problems in intermarket price adjustment. Returns of creameries and of producers may vary considerably in the short run, depending upon the market at the time shipments were made. Such disruption may extend beyond the butter market. The price of fluid milk and cream may fluctuate unreasonably where such prices are related to butter values, and price relationships between various manufactured dairy products may be disrupted.

Often, sharp short-time changes in the supply situation have created uncertainty as to the longer-term supply situation. Market situations of this type seem to precipitate further instability, setting in motion supply and demand responses at various levels of the trade from the creamery to the consumer. Such responses may not be instantaneous but take days or weeks to be felt.

Interactions of Price and Movement of Butter

The interaction of the forces of supply and demand upon price and of price on supply and demand constitutes a system of automatic control, or of checks and balances which come into play whenever prices get out of line with supply-demand conditions. With varying degree of quickness of response, forces are set in motion which tend to limit the extent and duration of maladjustment between price and supply and demand, and then to correct (or sometimes overcorrect) the maladjustment. Checks and balances are brought into play at all points in the marketing system from the creamery to the retail store and are brought to focus in the wholesale open market and on the mercantile exchange.

The process is similar to an automatic control mechanism such as a thermostat. The term "feedback" is sometimes used to describe the process. Automatic control systems are illustrated by a wide variety of happenings in nature and human affairs. A rabbit and lynx population cycle is an example of the "feedback" process. When rabbits are plentiful, the lynx population increases; but as the lynx population increases, the rabbit population decreases, bringing about a decrease in the lynx population which is followed by an increase in the rabbit population, and so on (9, pp. 48-55).

One of the characteristics and limitations of the feedback process is the fact that such systems may be subject to oscillatory behavior because of "self-excitation." Depending upon the strength of the feedback or response to the original oscillation, a situation may be created where, assuming a constant lag in response, there will be (1) a steady oscillation which maintains itself if the feedback is equal in strength to the original oscillation, (2) an oscillation which breaks into increasingly larger oscillations if the feedback exceeds the strength of the original oscillation, and (3) oscillations which will diminish if the feedback is weaker than the original oscillation (fig. 1)

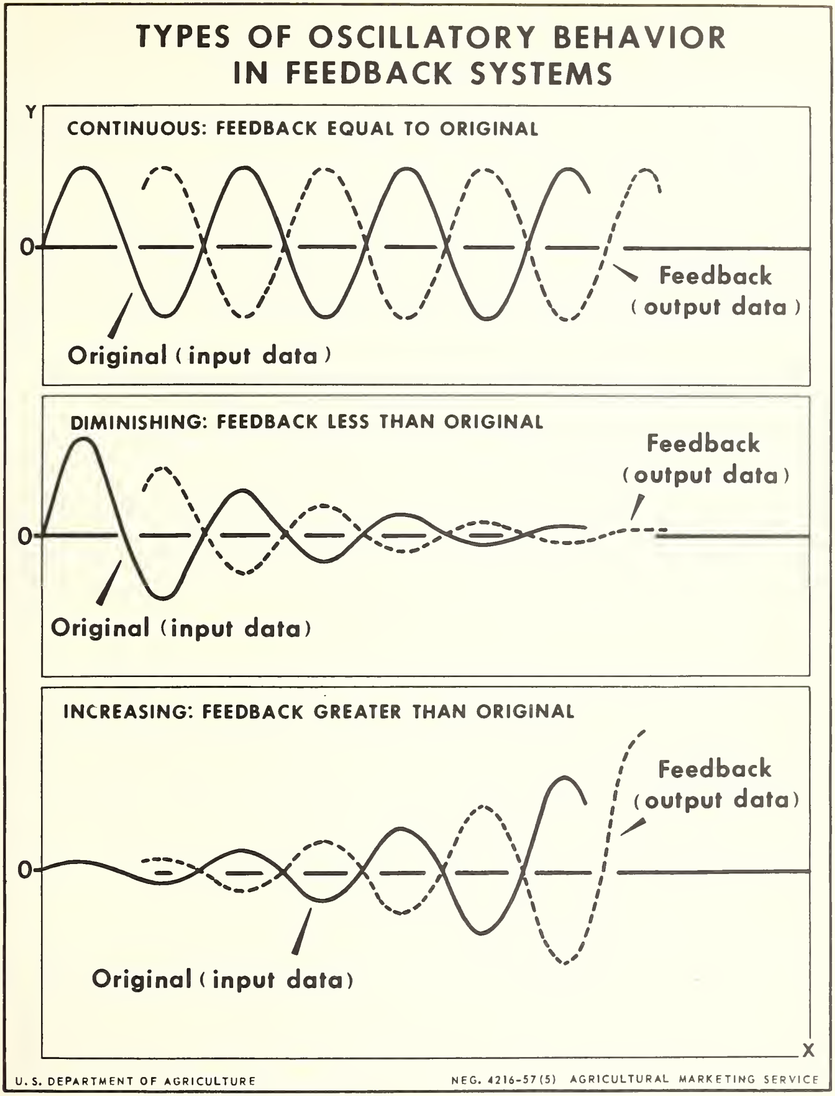
TYPES OF OSCILLATORY BEHAVIOR IN FEEDBACK SYSTEMS
Y
CONTINUOUS: FEEDBACK EQUAL TO ORIGINAL
0
Feedback (output data)
Original (input data)
DIMINISHING: FEEDBACK LESS THAN ORIGINAL
Feedback (output data)
0
Original (input data)
INCREASING: FEEDBACK GREATER THAN ORIGINAL
Feedback (output data)
0
Original (input data)
X
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Figure 1

The principles of feedback provide insight as to the manner in which the butter market operates and the reasons for price fluctuations. Further, they suggest, theoretically at least, how such fluctuations might be minimized. For example, key factors in short-time price fluctuations may be the strength of short-time response in price relative to short-time changes in supply and demand, or the size of the changes in supply and demand engendered by short-time changes in price. Also important, from the standpoint of stability, is the time required for the responses to take place.

Notable at many times in the butter market during 1946-52 was the tendency of the market to overadjust in one direction, leading to responses in short-time supply and demand which brought about subsequent overadjustments in price in the other direction, followed again by further supply-demand responses, and so on, a system of oscillations which tended to perpetuate itself. (See discussion of price phases pp. 10 and 11.)

EXTENT AND NATURE OF BUTTER PRICE FLUCTUATIONS

Tables 1, 2, and 3 show a frequency distribution of day-to-day changes in spot butter prices at Chicago by months for the years 1947, 1948, and 1951. Butter prices during these years tended to be relatively less stable during January, February, and March and during September, October, November, and December than during the in-storage season of April, May, June, July, and August. During these 3 years, only 16 changes of 2 cents or more occurred during the 5 months of April through August, whereas 53 changes of 2 cents or more occurred during the other 7 months.

Comparison of Price Fluctuations at Chicago and New York

During each of the years 1947, 1948, and 1951 the commercial quotations for the New York market varied more than the Chicago market quotations. In 1947, the Chicago quotation for Grade A butter changed 1/2 cent or more from the previous day on 131 occasions, whereas the New York market changed 1/2 cent or more 172 times. In 1948, the Chicago quotation changed 1/2 cent or more on 127 occasions while the New York quotation changed 1/2 cent or more on 188 occasions.

Difference in Price Associated With Day of Week

Receipts of butter vary considerably during the week and follow a rather definite pattern, with receipts relatively high on Mondays and Tuesdays and lowest in the middle of the week (fig. 2). Some persons have felt that receivers tended to take advantage of this situation and that, as a result, price declines were more likely to occur on Mondays and Tuesdays and increases on Wednesdays and Thursdays. For the years 1947, 1948, and 1951, no significant difference in average prices was associated with day of the week. As a further test, changes in price from the previous day were analyzed to see if

Table 1.--Frequency distribution of day-to-day changes in price of Grade A butter at Chicago, by months, 1947 1/

Day-to-day price change	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Cents	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
+4.25	--	1	--	--	--	--	--	--	--	--	--	--	1
+3.00	--	--	--	--	--	--	--	--	1	--	--	--	1
+2.50	--	1	--	--	--	--	--	--	--	1	--	--	2
+2.00	--	1	--	--	1	--	--	--	1	--	2	1	6
+1.50	--	1	2	--	--	2	--	3	--	1	2	--	11
+1.25	1	--	1	--	--	1	--	--	--	1	--	--	4
+1.00	1	1	--	--	1	2	2	3	2	3	3	5	23
+0.75	--	--	1	--	--	1	--	--	--	1	--	--	3
+0.50	5	2	1	4	4	2	6	4	2	2	2	1	35
+0.25	1	1	--	1	1	2	--	--	1	--	--	--	7
Total increases	8	8	5	5	7	10	8	10	7	9	9	7	93
0.00	6	7	10	9	11	8	12	8	8	7	9	11	106
Total decreases	8	5	6	8	3	3	2	3	6	7	1	4	56
-0.25	--	3	--	3	1	--	--	2	1	--	--	--	10
-0.50	1	--	--	2	--	--	--	--	1	--	--	1	5
-0.75	1	--	--	--	--	1	--	--	--	--	--	--	2
-1.00	--	2	--	1	--	--	1	1	1	2	--	3	11
-1.25	1	--	--	--	--	1	--	--	--	1	--	--	3
-1.50	1	--	2	--	2	1	--	--	--	1	--	--	7
-1.75	--	--	--	1	--	--	--	--	--	1	--	--	2
-2.00	1	--	--	1	--	--	1	--	2	1	--	--	6
-2.25	1	--	1	--	--	--	--	--	--	--	--	--	2
-2.50	1	--	1	--	--	--	--	--	--	1	1	--	4
-3.00	--	--	1	--	--	--	--	--	--	--	--	--	1
-3.50	--	--	--	--	--	--	--	--	1	--	--	--	1
-4.00	--	--	1	--	--	--	--	--	--	--	--	--	1
-4.75	1	--	--	--	--	--	--	--	--	--	--	--	1

1/ Price changes computed from daily price of 92-score butter published by Dairy Listing Service in Dairy and Poultry Year Book, 1947.

prices declined more frequently on certain days, and increased more frequently on certain days. No significant differences between days were found (fig. 3).

Table 2.--Frequency distribution of day-to-day changes in price of Grade A butter at Chicago, by months, 1948 1/

Day-to-day price change	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Cents	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
+8.00	--	--	1	--	--	--	--	--	--	--	--	--	1
+4.00	--	--	1	--	--	--	--	--	--	--	--	--	1
+3.00	1	1	--	--	--	--	--	--	--	--	--	--	2
+2.50	1	--	1	--	1	--	--	--	--	--	--	--	3
+2.00	1	1	--	1	1	--	--	1	--	--	1	--	6
+1.50	1	1	--	--	--	--	--	1	1	--	1	--	5
+1.25	--	--	--	--	1	--	--	--	--	1	1	--	3
+1.00	5	2	3	--	1	2	1	2	1	1	4	1	23
+0.75	--	--	--	--	1	--	--	--	--	--	1	--	2
+0.50	--	--	2	4	2	--	3	1	3	2	3	2	22
+0.25	--	--	--	--	--	--	--	--	--	--	--	--	--
Total increases	9	5	8	5	7	2	4	5	5	4	11	3	68
0.00	5	7	10	10	9	18	13	12	10	9	7	19	129
Total decreases	7	8	5	7	4	2	4	5	6	8	3	1	60
-0.25	--	--	--	--	--	--	--	--	--	1	--	--	1
-0.50	--	1	1	2	--	2	--	2	--	--	--	1	9
-0.75	--	--	--	--	--	--	--	--	--	1	--	--	1
-1.00	--	2	1	1	1	--	2	1	1	2	--	--	11
-1.25	--	--	--	--	--	--	--	--	--	--	1	--	1
-1.50	3	1	1	1	1	--	--	--	--	2	1	--	10
-2.00	3	1	--	2	1	--	1	--	2	2	--	--	12
-2.25	--	--	--	--	--	--	--	--	--	--	1	--	1
-2.50	1	--	1	--	1	--	1	1	2	--	--	--	7
-3.00	--	1	--	--	--	--	--	1	--	--	--	--	2
-4.00	--	--	--	--	--	--	--	--	1	--	--	--	1
-4.50	--	--	1	1	--	--	--	--	--	--	--	--	2
-5.00	--	1	--	--	--	--	--	--	--	--	--	--	1
-5.50	--	1	--	--	--	--	--	--	--	--	--	--	1

1/ Price changes computed from daily price of 92-score butter published by Dairy Listing Service in Dairy and Poultry Year Book, 1948.

Price Phases

During the period studied, day-to-day butter prices tended to exhibit definite price phases or oscillations (figs. 4-6). Existence of these price

Table 3.--Frequency distribution of day-to-day changes in price of Grade A butter at Chicago, by months, 1951 1/

Day-to day price change	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Cents	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
+2.00	--	--	--	--	--	--	--	--	--	--	--	2	2
+1.75	--	--	--	--	1	--	--	--	--	--	--	--	1
+1.00	2	--	--	--	1	--	--	--	--	--	2	1	6
+0.75	1	--	--	--	--	--	--	--	1	--	1	1	4
+0.50	1	2	--	3	--	1	2	--	3	--	4	2	18
+0.25	--	--	--	--	2	4	3	7	3	7	3	3	32
Total increases	4	2	--	3	4	5	5	7	7	7	10	9	63
0.00	16	12	19	17	16	11	8	12	9	16	11	10	157
Total decreases	2	6	3	1	2	5	8	4	3	--	--	1	35
-0.25	--	1	1	--	1	1	2	2	3	--	--	1	12
-0.50	1	3	1	1	--	2	5	2	--	--	--	--	15
-0.75	--	2	1	--	1	2	1	--	--	--	--	--	7
-3.00	1	--	--	--	--	--	--	--	--	--	--	--	1

1/ Price changes computed from daily price of 92-score butter published by Dairy Listing Service in Dairy and Poultry Year Book, 1951.

phases indicated the inability of the market to adjust effectively to changing market conditions; a tendency toward overadjustment was often evident. On the other hand, the length of a number of these price phases indicates that while the market often oscillated severely, the market was not characterized by numerous very short random oscillations but rather by definite upward and downward price movements. Of the 453 trading days included in upward price phases, 389, or 86 percent, were included in price phases of 9 days or longer; and of the 358 trading days included in downward price phases, 276 days, or 77 percent, were included in price phases of 9 days or longer. A price phase was considered as a period of time during which the market exhibited consistent tendencies one way or the other. No change in price or a small "contra-movement" during a period in which the market was clearly moving in one direction or the other, was not considered to terminate a price phase if the price phase was maintained on subsequent days.

Table 4 shows a frequency distribution of price phases during the period studied, and table 5 shows chronologically the various upward and downward price movements during the years 1947, 1948, 1951, and 1952.

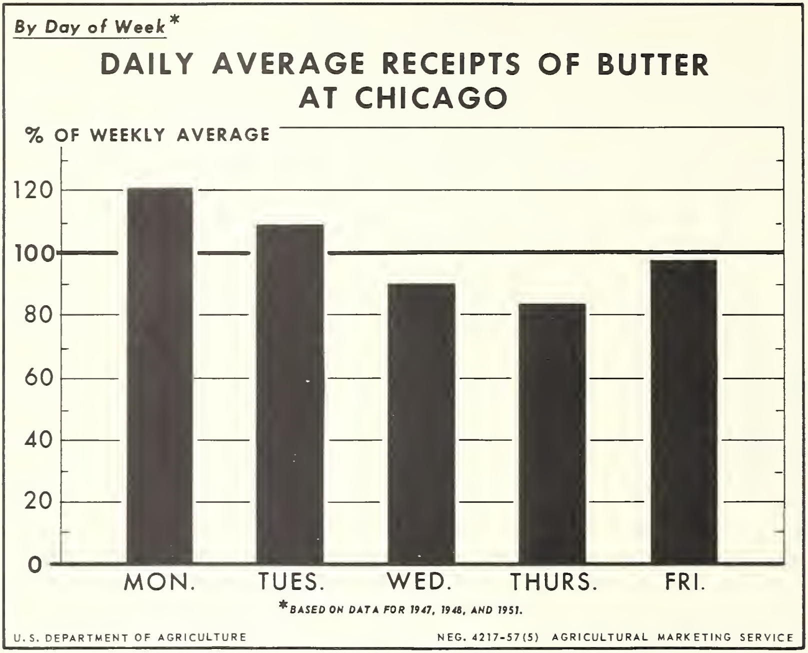

Figure 2

Relationship Between Prices at Chicago and New York

Theoretically the price of butter at New York would be expected to exceed the price at Chicago by the cost of transportation between the two markets. Actually, the spread between the two markets has ranged for extended periods from nothing to twice the cost of transportation. During the heavy production season the difference between the New York price and the Chicago price has tended to be considerably less than the cost of transporting butter between the two markets. This may in part reflect a stronger demand for butter for storage in Chicago than in New York. It also may reflect a tendency for creameries to continue supplying a particular market rather than to "shop around" for short-time price advantages (1). Figure 7 indicates average monthly differences in price which prevailed between the 2 markets during 1947, 1948, and 1951.

Although the price differential between the two markets may vary, prices in these markets usually follow each other very closely. Because of difference

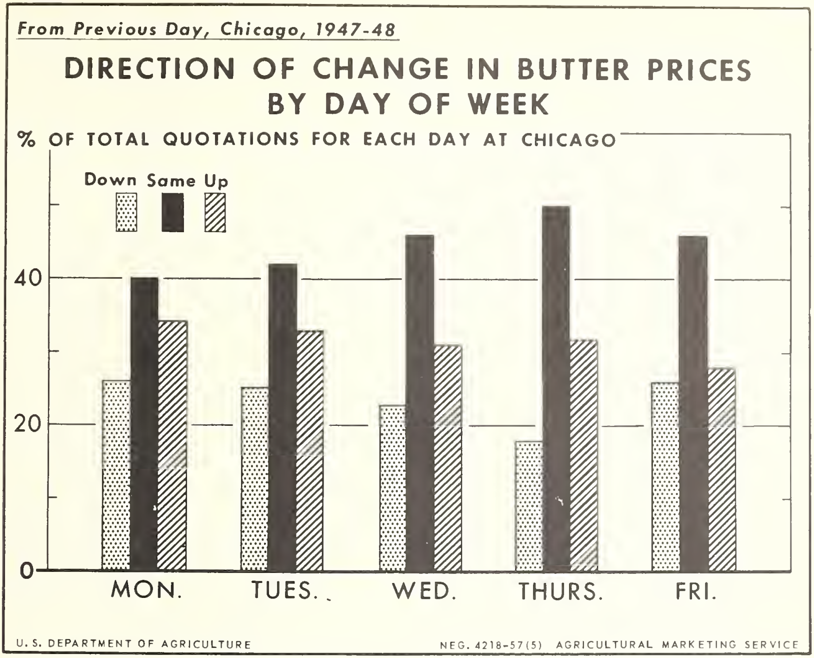

Figure 3

in the time at which trading takes place, happenings in New York are known to traders in Chicago before the trading on the spot call of the Chicago Mercantile Exchange begins. Likewise, happenings in the Chicago market affect the New York market the following day. During 1947, 40 percent of the change in price at Chicago was associated with changes in New York the same day, and 25 percent of the change at New York was associated with change at Chicago the previous day. During 1948, 43 percent of change at Chicago was associated with change the same day at New York, and 16 percent of the change at New York was associated with changes at Chicago the previous day.

Table 6 shows by months the percentage of the change in price at Chicago associated with change in price at New York the same day and shows by months the percentage of the change in price at New York associated with change at Chicago the previous day. The Chicago market is relatively more stable than the New York market; yet changes at New York appear to influence the Chicago market more than changes at Chicago influence New York. The difference in time of trading in the two markets probably influences the relationship

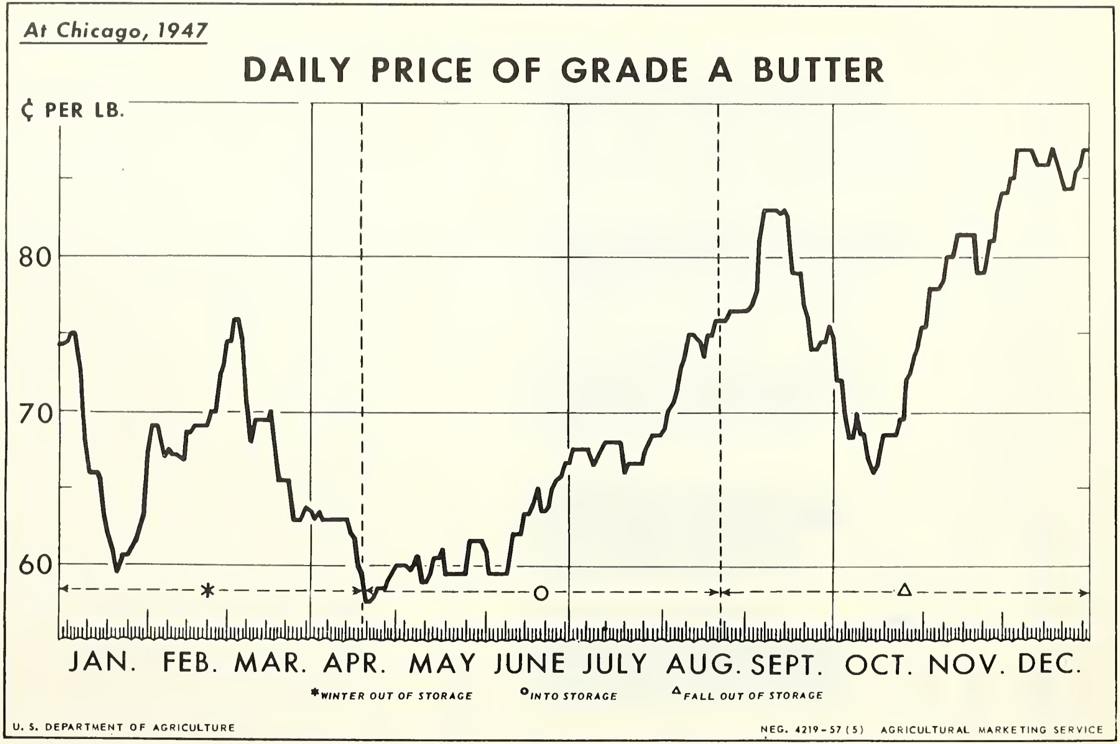
At Chicago, 1947
DAILY PRICE OF GRADE A BUTTER
¢ PER LB.
80
70
60
JAN.
FEB.
MAR.
APR.
MAY
JUNE
JULY
AUG.
SEPT.
OCT.
NOV.
DEC.
*WINTER OUT OF STORAGE
○INTO STORAGE
△FALL OUT OF STORAGE
U. S. DEPARTMENT OF AGRICULTURE
NEG. 4219-57 (5) AGRICULTURAL MARKETING SERVICE

Figure 4

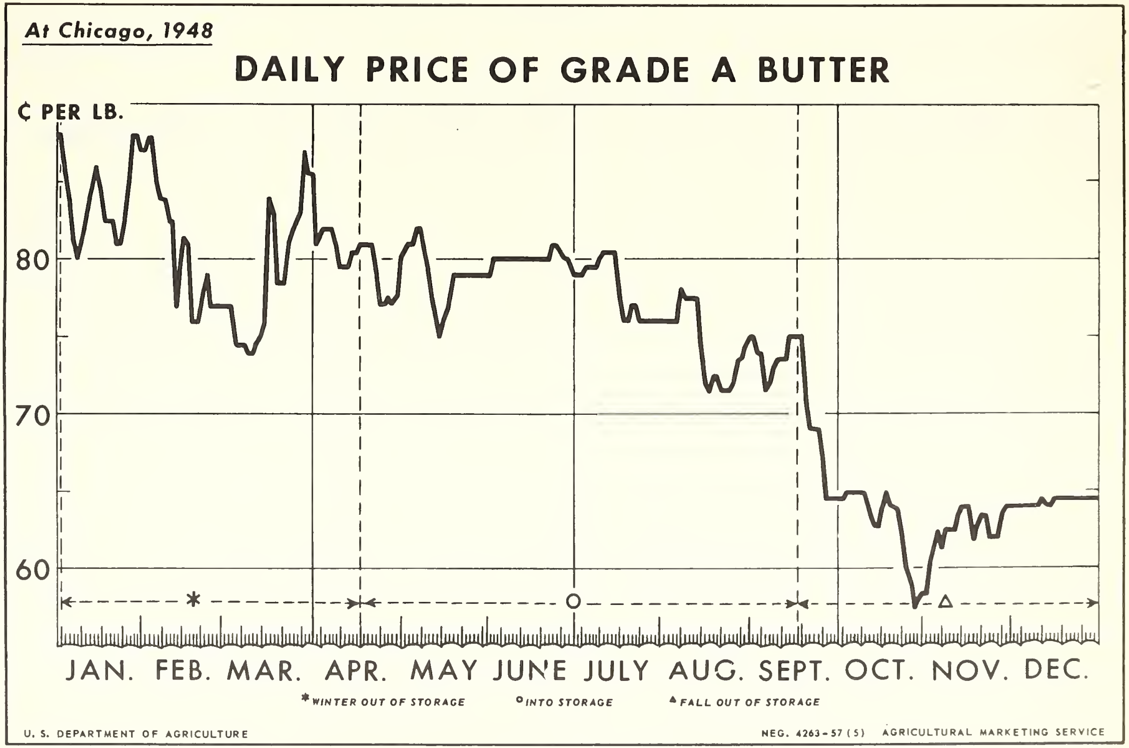
At Chicago, 1948
DAILY PRICE OF GRADE A BUTTER
¢ PER LB.
80
70
60
*
o
△
JAN.
FEB.
MAR.
APR.
MAY
JUNE
JULY
AUG.
SEPT.
OCT.
NOV.
DEC.
* WINTER OUT OF STORAGE
o INTO STORAGE
▲ FALL OUT OF STORAGE
U. S. DEPARTMENT OF AGRICULTURE
NEG. 4263-57 (5)
AGRICULTURAL MARKETING SERVICE

Figure 5

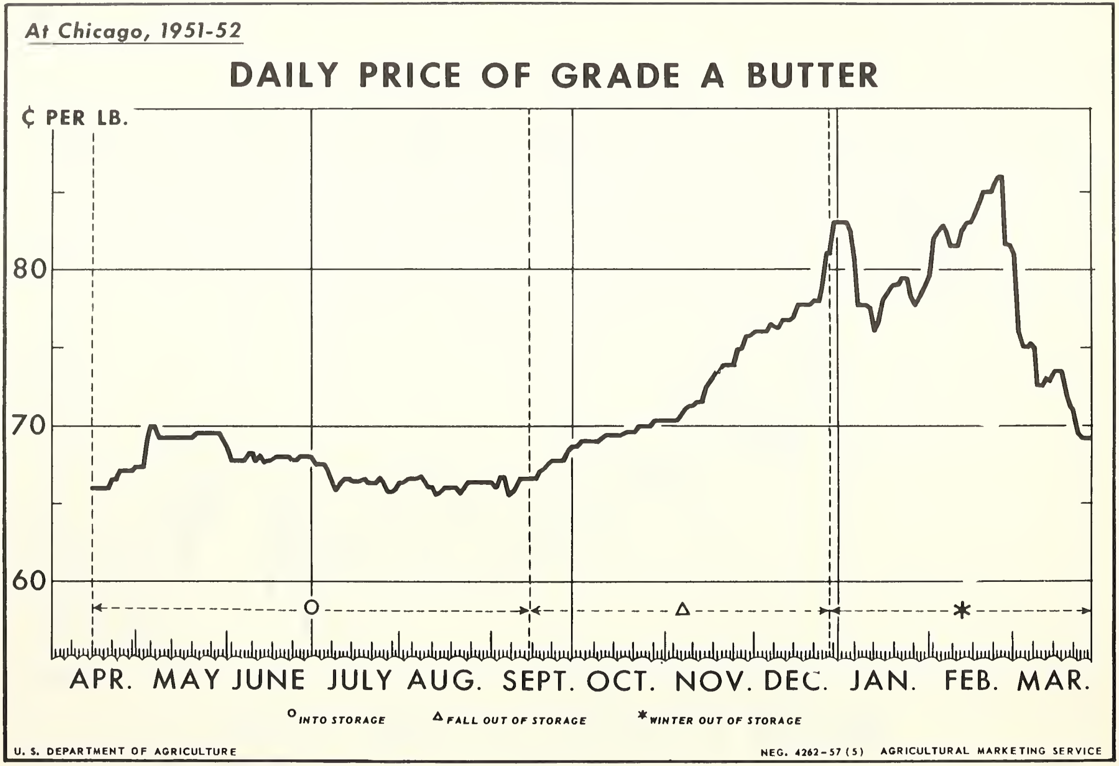
At Chicago, 1951-52
DAILY PRICE OF GRADE A BUTTER
¢ PER LB.
80
70
60
APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR.
○ INTO STORAGE
△ FALL OUT OF STORAGE
* WINTER OUT OF STORAGE
U. S. DEPARTMENT OF AGRICULTURE
NEG. 4262-57 (5) AGRICULTURAL MARKETING SERVICE

Figure 6

Table 4.--Frequency distribution showing varying length of time butter market moved in substantially the same direction on consecutive trading days, 1947, 1948, 1951, and January-March 1952 1/

Length of price movement	Number of price movements			Number of days included in price movement			Proportion of trading days included in price phases of varying length		
	Rising market	Declining market	Total	Rising market	Declining market	Total	Rising market	Declining market	Total
	Number	Number	Number	Number	Number	Number	Percent	Percent	Percent
50-76 days	3	2	1	199	144	55	24.5	31.7	15.3
40-49 days	1	1	--	43	43	--	5.3	9.5	--
35-39 days	2	1	1	76	38	38	9.4	8.4	10.6
30-34 days	1	--	1	32	--	32	3.9	--	9.0
25-29 days	3	2	1	81	53	28	10.0	11.7	7.8
20-24 days	2	--	2	43	--	43	5.3	--	12.0
15-19 days	2	1	1	36	18	18	4.4	4.0	5.0
10-14 days	7	4	3	83	48	35	10.3	10.6	9.8
9 days	8	5	3	72	45	27	8.8	9.9	7.5
8 days	1	1	--	8	8	--	1.0	1.8	--
7 days	4	1	3	28	7	21	3.5	1.5	5.9
6 days	5	2	3	30	12	18	3.7	2.7	5.0
5 days	4	2	2	20	10	10	2.4	2.2	2.8
4 days	9	4	5	36	16	20	4.5	3.5	5.6
3 days	4	1	3	12	3	9	1.5	.7	2.5
2 days	6	4	2	12	8	4	1.5	1.8	1.2
Total	62	31	31	811	453	358	100.0	100.0	100.0

1/ If direction of movement was subsequently maintained, price phase was not considered to be terminated by either no change or small contraadjustment.

Table 5.--Short-time price phases in daily price of Grade A butter at Chicago, 1947, 1948, 1951, and January-March 1952 1/

Period	Number of trading days 2/	Extent of price increase or decrease	Number of contramovements	
			1-1½¢	Less than 1¢
1947				
Dec. 31, 1946 - Jan. 8	5	+1.25	--	--
Jan. 8 - Jan. 22	10	-15.50	--	--
Jan. 22 - Feb. 5	10	+9.50	--	--
Feb. 5 - Feb. 14	6	-2.25	--	1
Feb. 14 - Mar. 6	14	+9.25	--	--
Mar. 6 - Apr. 22	32	-18.50	1	3
Apr. 22 - May 19	18	+3.50	1	1
May 19 - May 26	6	-1.50	--	--
May 26 - May 29	3	+2.00	--	--
May 29 - June 9	6	-2.00	--	--
June 9 - Sept. 15	67	+23.50	4	3
Sept. 15 - Oct. 15	22	-17.00	2	1
Oct. 15 - Dec. 11	38	+21.00	1	--
Dec. 11 - Dec. 24	9	-2.50	1	--
Dec. 24 - Jan. 5, 1948	6	+3.50	--	--
1948				
Jan. 5 - Jan. 9	4	-8.00	--	--
Jan. 9 - Jan. 16	5	+6.00	--	--
Jan. 16 - Jan. 26	6	-5.00	--	--
Jan. 26 - Jan. 30	4	+7.00	--	--
Jan. 30 - Feb. 13	9	-11.00	1	--
Feb. 13 - Feb. 17	2	+4.50	--	--
Feb. 17 - Feb. 20	3	-5.50	--	--
Feb. 20 - Feb. 25	2	+3.00	--	--
Feb. 25 - Mar. 11	11	-5.00	--	--
Mar. 11 - Mar. 17	4	+10.00	--	--
Mar. 17 - Mar. 23	4	-5.50	--	--
Mar. 23 - Mar. 30	4	+8.50	--	--
Mar. 30 - Apr. 2	3	-6.00	--	--
Apr. 2 - Apr. 8	4	+1.00	--	--
Apr. 8 - Apr. 14	4	-2.50	--	--
Apr. 14 - Apr. 16	2	+2.00	--	--
Apr. 16 - Apr. 27	7	-4.50	--	--
Apr. 27 - May 10	9	+5.00	--	1
May 10 - May 17	5	-7.00	--	--
May 17 - June 25	28	+6.00	--	--

See footnotes at end of table.

Continued

Table 5.--Short-time price phases in daily price of Grade A butter at Chicago, 1947, 1948, 1951, and January-March 1952 1/--Continued

Period	Number of trading days 2/	Extent of price increase or decrease	Number of contramovements	
			1-1½¢	Less than 1¢
June 25, 1948 - July 2	5	-2.00	--	--
July 2 - July 16	9	+1.50	--	--
July 16 - Aug. 25	28	-9.00	3	--
Aug. 25 - Sept. 2	6	+3.50	--	--
Sept. 2 - Sept. 7	2	-3.50	--	--
Sept. 7 - Sept. 20	9	+3.50	--	--
Sept. 20 - Oct. 15	18	-12.25	--	1
Oct. 15 - Oct. 19	2	+2.25	--	--
Oct. 19 - Oct. 28	7	-7.50	--	--
Oct. 28 - Dec. 31	43	+8.00	3	1
1951				
Dec. 31, 1950 - Jan. 19	14	-2.50	--	--
Jan. 19 - Feb. 5	11	+2.25	--	--
Feb. 5 - Apr. 3	38	-4.25	--	2
Apr. 3 - May 8	25	+4.50	--	--
May 8 - July 26	55	-4.75	--	9
July 26 - Aug. 8	9	+1.50	--	--
Aug. 8 - Aug. 14	4	-1.25	--	--
Aug. 14 - Aug. 31	13	+.75	--	1
Aug. 31 - Sept. 7	4	-.75	--	--
Sept. 7 - Dec. 31	76	+17.50	--	1
1952				
Dec. 31, 1951 - Jan. 14	9	-7.00	--	--
Jan. 14 - Jan. 24	8	+3.50	--	--
Jan. 24 - Jan. 28	2	-1.75	--	--
Jan. 28 - Feb. 6	7	+5.25	--	--
Feb. 6 - Feb. 11	3	-1.50	--	--
Feb. 11 - Feb. 27	10	+4.50	--	--
Feb. 27 - March 28	22	-16.75	--	3

1/ Price phase was considered to include period of time market exhibited consistent tendencies to move one way or the other. Other price movements during the period of time studied are also indicated, although they may not represent definite cyclical tendencies. No change in price or a small contramovement during a period in which the market was clearly moving in one direction or the other, was not considered to terminate a price phase if the price phase was maintained on subsequent days.

2/ Calculated as the number of trading days after the beginning date and including the final date of each period.

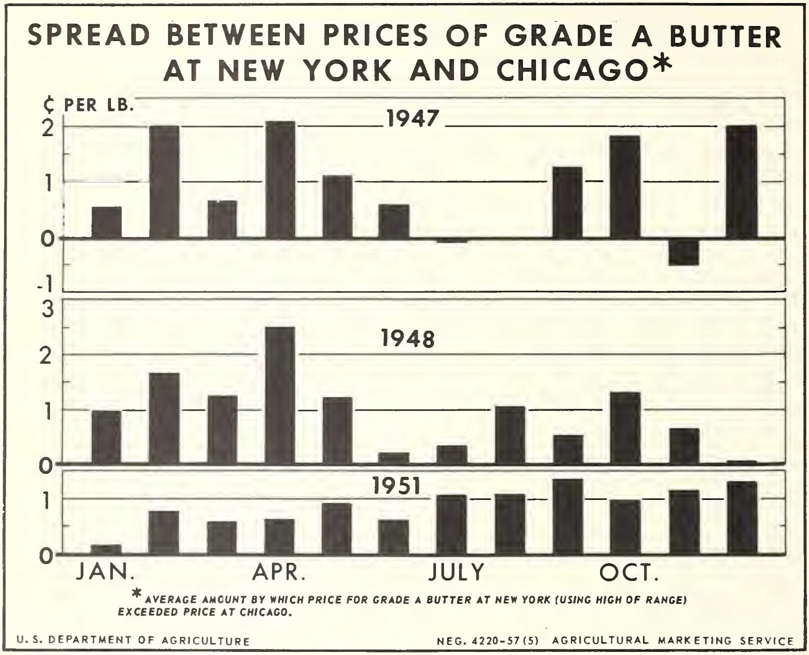

Figure 7

between them. While both markets are affected by information available on the same day, the New York market is also affected by happenings at Chicago the previous day.

Intermarket adjustments have at times accentuated price fluctuations in the butter market and point to the need for minimizing the disruptive effects of adjustments between the two major markets.

The relative amount of change in price at Chicago associated with a price change at New York tends to vary considerably from time to time. This relationship shows seasonal tendencies, with the relationship higher near the end of the out-of-storage season in the spring and the beginning of the out-of-storage season in the fall and less pronounced during the in-storage season.

NORMAL PATTERN OF BUTTER PRICES DURING THE MARKETING YEAR

Butter prices tend to follow a normal seasonal pattern. Shorter time changes in price occur within the framework of this seasonal price pattern.

Table 6.--Percentage change in price of Grade A butter at Chicago associated with change in price at New York and percentage change in price at New York associated with change at Chicago, by months, 1947-48 1/

Month	Change at Chicago associated with change at New York same day		Change at New York associated with change at Chicago previous day	
	1947	1948	1947	1948
	Percent	Percent	Percent	Percent
January	27	72	48	20
February	52	20	10	5
March	75	51	33	24
April	24	30	14	14
May	8	45	36	41
June	53	9	7	4
July	29	53	4	19
August	14	54	28	18
September	49	55	25	6
October	28	75	34	21
November	33	45	19	4
December	48	1	3	6
Year	40	43	25	16

1/ Percentages are the coefficients of determination, that is, the squares of the simple correlation coefficients.

In analyzing short-time price changes, the underlying longer term factors influencing prices must be considered.

The marketing year for butter begins in the spring at the time that the previous year's storage stocks have been depleted. At that time the movement into storage consistently exceeds the out-of-storage movement. This generally occurs about the middle of April and is associated with the sharp seasonal increase in production. This transition is typically followed by a decline in prices.

In-Storage Season

During May, June, July, and August, approximately 70 percent of the total in-storage movement occurs. The level of price during this period is governed primarily by the anticipation of the trade as to what butter will be worth during the fall and early winter out-of-storage season. Such judgment, of course, is constantly influenced by changes in the supply-demand situation as the season advances.

When butter is moving into storage, the heavy rate of production and the willingness of receivers to store lend a degree of stability to the market which is not present during the out-of-storage season. The market appears better able to adjust itself while supplies are large, and adjusts to changes in supply-demand conditions more gradually than at times when receivers are less willing to store surpluses. It is likely also, that during the heavy in-storage season long-term supply-demand factors are more influential and that a greater unity of interests with respect to price exists than at other times.

During the in-storage season, the relatively few wholesalers who are willing to accept large quantities of others' surpluses are active in the trading on the spot butter market of the mercantile exchange. The price is, in large part, the price these "risk takers" are willing to pay for butter to store (2, pp. 848-866). The butter futures market has a stabilizing effect on the cash market during the in-storage season, and the opportunity which the futures market provides to hedge holdings is an important factor in the willingness of some distributors to store. Speculative demand for butter during the in-storage season does not seem to cause violent short-time price fluctuations. Furthermore, during the in-storage season, the supply of and demand for butter are generally much more elastic than at other times. Relatively small price changes are required to adjust for changes in supply and demand because the effects of such changes may be spread out over a period of time. During the out-of-storage season, changes in supply must be adjusted for completely on a current basis.

Ordinarily, the period of maximum accumulation of stocks is reached about the middle of September. After this point is reached, the rate of movement of butter out-of-storage exceeds the in-storage movement. By November, when production has reached its seasonal low, the out-of-storage movement exceeds many times the in-storage movement.

Fall Out-of-Storage Season

The period following the beginning of the fall out-of-storage season is generally characterized by increasing prices. Attention of those who store then turns from evaluating the market in terms of the price at which they are willing to store butter to evaluating the market in terms of the price at which they are willing to sell existing supplies. This price is influenced largely by the price at which those who are short of storage supplies are willing to buy.

Long-term factors are still in the picture, but in a different way. With the storage supply "made," the rate of disappearance in relation to stocks, plus anticipated production during the low production period of October through January, is of prime importance. Those who have accumulated large supplies of storage stocks in addition to their own distributive needs are again active in the trading on the spot butter markets of the exchange. The market is affected much less by speculative demand now and more by the demand of those with inadequate storage supplies and those who normally plan to buy supplies on the open market during the period of low production in the fall and early winter. Short-time changes in production or consumption now seem to be much more important as factors influencing the demand for storage butter and the willingness of those holding storage butter to sell it. The process of balancing supplies between "haves" and "have nots" at times creates considerable day-to-day variation in prices, and the market is more sensitive and responsive to short-time variations in supply or demand during this period.

Winter Out-of-Storage Season

In late January the market is usually at highest levels of the year; butter production is beginning to increase from its seasonal low but is not yet adequate to meet day-to-day needs. The market situation is unstable and values often decline sharply during late January and early February. An unexpected increase in supplies may have undue influence on the market at this time because of the unwillingness of the trade to store butter when values are expected to decline. Such short-time adjustments may engender equally large readjustments in the opposite direction a few days later if the supply situation tightens up. Late January and February are frequently characterized by several rather sharp price adjustments. Rarely do prices adjust gradually to increasing production early in the year. Instability often lasts until the beginning of the in-storage season.

Within this framework of seasonal characteristics of the market, the shorter term supply-demand factors constantly influence the judgment of the trade and prices are being reappraised continually. Dominant in the process are a relatively few "risk takers," who, on the one hand, are willing to accept others' surpluses (at a price) during the heavy production season and who are willing to sell storage butter to those who need it (at a price) during the short production season.

ANALYSIS OF FACTORS THAT INFLUENCE BUTTER PRICES IN THE SHORT RUN

Before testing any relationships between supply and demand factors and price, it was necessary to consider the information as to short-time changes in supply and demand which is available to butter receivers and to make preliminary judgment as to which of these factors would influence the price most. The nature of trading in the wholesale butter markets, the mechanics by which prices are adjusted, and the manner in which traders in the central markets decide that prices are too high or too low were considered.

It was necessary also to decide what measure, or measures, of price to use. Prices are quoted for 6 descriptions of butter at Chicago and 4 at New York. Because of the large amount of data involved, and because supply-demand information is not generally on the basis of grades, it was decided to use prices for only one grade of butter and for only one market. Prices for Grade A butter at Chicago were used because this grade was felt to be the most representative one pricewise, and the Chicago market was felt to be more representative of national market conditions than New York.

Market Information Available from Published Sources

A number of indicators of short-time changes in the supply of and demand for butter are followed closely by the trade and would be expected to influence day-to-day changes in spot butter prices. Most of such information is reported regularly by the Agricultural Marketing Service, U. S. Department of Agriculture. Some of these indicators are published daily in the Daily Market Report issued by the Dairy and Poultry Market News Service. Other information is published weekly or monthly.

Published information as to supply includes:

1. Weekly butter production in United States (this report, released by the Agricultural Marketing Service, gives a breakdown, by regions and States, of changes in production from the previous week and previous year. The American Butter Institute also issues a weekly butter production estimate).

2. Monthly butter production in the United States.

3. Daily receipts of butter at Chicago, New York, Philadelphia, and Boston.

4. Weekly cold storage holdings of butter at 35 markets.

5. Daily cold storage holdings of butter at Chicago, New York, Philadelphia, and Boston.

6. Daily cold storage holdings of butter at 10 major markets.

7. Monthly cold storage holdings of butter in the United States.

Published information as to demand includes:

1. Weekly movement of butter into retail channels.

2. Weekly trade output at Chicago, New York, Philadelphia, and Boston. (This may be computed from published information as to receipts and changes in storage holdings and in dealers' floor stocks.)

Other published information indicative of the balance or lack of balance between supply and demand include:

1. Dealers' floor stocks at Chicago, weekly. (Daily information is available, but it is not published.)

2. Daily net movement of butter into or out of storage at New York, Chicago, Philadelphia, and Boston.

Certain price relationships would be expected to affect day-to-day changes in butter prices. The most important of these are: The spread between the Chicago and New York market quotations; the spread between cash butter market at Chicago and butter futures market; and the spread between prices for various grades of butter.

Other information concerning longer term expectations that would affect prices include: Announcement of Government action relating to the dairy industry or competing products, current events that influence consumer income, Government outlook information, information about changes in the demand for other dairy products, changes in the level of milk production, and reports of drought conditions in production areas.

Daily market comments of commercial and USDA market reporters at Chicago, New York, and elsewhere provide additional information as to the market situation and are important sources of information.

Market Information Available from Unpublished Sources

In addition to published information as to supply and demand for butter, receivers also obtain important information during the course of their business activities. Examples of this type of information are: (1) Information and impressions obtained from conversations with other members of the trade; (2) inquiries from customers or competitors, and their reaction to inquiries, about buying or selling supplies; (3) conversations with creamery managers about production plans; (4) observation of competitors' willingness or lack of willingness to buy or sell, as indicated by trading on the spot butter board of the mercantile exchange; and (5) probably the most important of all to an individual dealer, the extent to which his current supply is in balance with his needs.

For the most part, such information would be expected to give the dealer somewhat the same picture of the market as that obtained from published information, although to some extent it may be more timely and often may be less representative of the overall picture than published information. Published information provides a means for dealers to verify impressions obtained during the course of business and supplements unpublished information.

One limitation of the statistical analysis is that there is no way by which this unpublished information may be included in the analysis.

Factors Used in Statistical Analysis

A number of measures of supply and demand which would be expected to influence the price of butter were tabulated. These various supply or demand factors were often expressed in several different ways, such as change from previous day, change from previous week, or change from 5-day moving average. The manner in which the statistical analysis was set up is discussed in detail in the appendix (p. 58).

Price in all cases was considered as the dependent variable; and changes in factors such as production, receipts, and storage holdings, were considered as the variables affecting price and were treated as the independent variables in the analysis. The factors to be used in the multiple regression analysis were selected on the basis of their interdependence as ascertained by preliminary calculations of coefficients of determination. These measurements, which are the squares of the simple correlation coefficients, were expressed as percentages; they represent the percentage of the variation in one variable which is explained by the variation in a second variable. As far as possible, the factors selected for the equation for each marketing season were those which had a relatively high correlation with the price changes being studied (daily or weekly) and a relatively low correlation with the other independent factors in the set.

The relationship between 20 supply or demand factors and price changes was examined for 10 marketing seasons encompassing 811 trading days. Two separate measures of price change were used--change from previous day and change from same day, previous week. The information was punched on cards and many of the calculations were performed mechanically.

The following supply or demand factors were included in the correlation analysis: 3/

1. Weekly butter production in U. S., as percentage change from preceding week.
2. * + Weekly butter production in Wisconsin, as percentage change from annual rate for preceding week.
3. + Annual rate of U. S. butter production, as percentage change from annual rate for preceding week.
4. * Daily receipts at Chicago adjusted for variation within week as percentage change from moving average for preceding 5 days.
5. + Five-day moving average of receipts at Chicago, as percentage change from moving average for preceding 5 days.
6. * Weekly cold storage holdings in 35 markets, as percentage change from expected holdings.
7. + Weekly cold storage holdings in 35 markets, as percentage change from holdings for preceding week.

3/ Asterisk (*) indicates factor was used in multiple regression equation(s) relating to daily price change. (See table 9, Appendix, pp. 63-64.)
Plus sign (+) indicates factor was used in multiple regression equation(s) relating to weekly price change. (See table 10, Appendix, pp. 65-66.)

8. Net cold storage movement at Chicago, as change from moving average for preceding 5 days.

9. Five-day moving average of net cold storage movement at Chicago, as change from moving average for preceding 5 days.

10. Daily dealers' floor stocks at Chicago, as percentage change from floor stocks for preceding day.

11. * Daily dealers' floor stocks at Chicago, as percentage change from moving average for preceding 5 days.

12. + Five-day moving average of dealers' floor stocks at Chicago, as percentage change from moving average for preceding 5 days.

13. * Weekly movement into retail channels at Chicago, as percentage change from preceding week's movement.

14. + Weekly movement into retail channels at Chicago, as percentage change from 4-week moving average.

15. Daily trade output at Chicago, as percentage change from output for preceding day.

16. * Daily trade output at Chicago, adjusted for variation within week, as percentage change from moving average for preceding 5 days.

17. + Five-day moving average of trade output at Chicago, as percentage change from moving average for preceding 5 days.

18. * Butter futures price, as change from preceding day.

19. Butter futures price, as change from preceding day, lagged 1 day.

20. * Deviation between futures market and cash market plus estimated cost of storage.

RESULTS OF STATISTICAL ANALYSIS

Variation in Daily Prices Explained by Various Factors 4/

During 1947, 1948, and 1951 a relatively small part of the daily variation in prices of butter at Chicago could be explained by various measures of supply and demand. During certain marketing seasons some factors appeared to explain a rather significant part of the total day-to-day change; yet during comparable

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4/ Based on coefficients of determination, that is, the squares of the simple correlation coefficients.

marketing seasons of another year the same factors explained less than 1 percent of the change. Table 7 shows the percentage of the change in price during the 10 marketing seasons studied associated with changes in various measures of supply or demand.

Dealers' floor stocks

Dealers' floor stocks expressed as a percentage of the preceding 5-day moving average explained a part of the day-to-day variation in price more consistently than did any other factor. During all but two of the marketing seasons this factor explained a statistically significant part of the day-to-day change. Floor stocks explained 15 percent of the change during the in-storage season in 1948 and 13 percent of the variation in price in the late winter out-of-storage season in 1952.

Production

Butter production, when expressed as a percentage change from the previous week, accounted for 11 percent, less than 1 percent, and 3 percent of the change during the 3 fall out-of-storage periods. Production of butter in Wisconsin, when expressed in terms of change from the previous week, explained 13 percent of the day-to-day change during the fall out-of-storage period in 1947, and 7 and 10 percent of the day-to-day change during the winter out-of-storage periods in 1947 and 1952, respectively. When U. S. production was expressed as percentage change in annual rate of production it explained 10 percent and 14 percent, respectively, of the day-to-day change in price during the fall out-of-storage seasons of 1947 and 1951.

Cold storage holdings

Cold storage holdings in 35 markets, expressed as a percentage of anticipated holdings, explained 21 percent of day-to-day variation in price during the fall out-of-storage season in 1951, and a small part of the change during each of the 3 marketing seasons of 1947, but provided no significant explanation for other periods.

Receipts

Receipts adjusted for variation within the week and expressed as a percentage of a 5-day moving average explained 6 percent of the variation in the fall of 1951 and 5 percent of the variation in the late winter and early spring of 1952, but provided little explanation of variation during other periods studied.

Movement into retail channels

Movement into retail channels explained 6 percent of the day-to-day change during the late winter out-of-storage season of 1951, but explained very little of the change during other periods.

Table 7.--Percentage of the variation in daily changes in price of Grade A butter at Chicago which can be explained by variation in selected measures of supply and demand for butter, by marketing seasons, 1947, 1948, 1951, and January-March 1952 1/

Supply-demand factors	Marketing seasons									
	Winter out-of-storage				In-storage			Fall out-of-storage		
	1-2-47 to 4-18-47 (75 days)	1-5-48 to 4-16-48 (72 days)	1-2-51 to 4-13-51 (71 days)	12-31-51 to 3-28-52 (62 days)	4-21-47 to 8-22-47 (88 days)	4-19-48 to 9-17-48 (107 days)	4-16-51 to 9-14-51 (107 days)	8-25-47 to 1-2-48 (88 days)	9-20-48 to 12-31-48 (71 days)	9-17-51 to 12-28-51 (70 days)
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Weekly butter production in U. S., as percentage change from preceding week........	3(-)	1(-)	a(+)	7(-)	a(-)	a(-)	7(-)	11(-)	a(-)	3(-)
Weekly butter production in Wisconsin, as percentage change from preceding week.	7(-)	2(-)	1(-)	10(-)	1(-)	2(+)	a(+)	13(-)	1(-)	a(+)
Annual rate of U. S. butter production, as percentage change from annual rate for preceding week.........	a(-)	a(+)	a(-)	3(-)	3(+)	a(+)	6(-)	10(-)	1(-)	14(-)
Daily receipts at Chicago, adjusted for variation within week, as percentage change from moving average for preceding 5 days.......	a(-)	a(-)	a(-)	5(+)	1(-)	a(-)	a(+)	2(-)	1(-)	6(+)
Weekly cold storage holdings in 35 markets, as percentage change from expected holdings..........	5(-)	a(+)	a(-)	a(+)	6(-)	a(-)	1(+)	2(+)	a(-)	21(+)
Net cold storage movement at Chicago, as change from moving average for preceding 5 days.............	1(+)	a(+)	1(-)	1(-)	1(+)	a(+)	1(-)	8(-)	a(-)	a(-)

See footnotes at end of table.

Continued

Table 7.--Percentage of the variation in daily changes in price of Grade A butter at Chicago which can be explained by variation in selected measures of supply and demand for butter, by marketing seasons, 1947, 1948, 1951 and January-March 1952 [1]--Continued

Supply-demand factors	Marketing seasons									
	Winter out-of-storage				In storage			Fall out-of-storage		
	1-2-47 to 4-18-47 (75 days)	1-5-48 to 4-16-48 (72 days)	1-2-51 to 4-13-51 (71 days)	12-31-51 to 3-28-52 (62 days)	4-21-47 to 8-22-47 (88 days)	4-19-48 to 9-17-48 (107 days)	4-16-51 to 9-14-51 (107 days)	8-25-47 to 1-2-48 (88 days)	9-20-48 to 12-31-48 (71 days)	9-17-51 to 12-28-51 (70 days)
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Daily dealers' floor stocks at Chicago, as percentage change from floor stocks for preceding day..........	4(-)	1(-)	1(-)	2(-)	1(-)	6(-)	3(-)	1(-)	4(-)	3(+)
Daily dealers' floor stocks at Chicago, as percentage change from moving average for preceding 5 days...	6(-)	6(-)	3(-)	13(-)	1(-)	15(-)	1(-)	4(-)	5(-)	a(-)
Weekly movement into retail channels at Chicago, as percentage change from preceding week's movement..	1(-)	a(-)	6(+)	1(+)	1(-)	1(+)	a(+)	1(+)	2(-)	1(+)
Daily trade output at Chicago, as percentage change from output for preceding day...	a(+)	1(-)	a(-)	a(+)	a(-)	a(-)	a(+)	1(-)	a(+)	a(-)
Daily trade output at Chicago, adjusted for variation within week, as percentage change from moving average for preceding 5 days.......	1(+)	a(+)	a(-)	4(+)	2(-)	a(+)	1(+)	1(+)	a(+)	a(+)
Butter futures price, as change from preceding day..	10(+)	22(+)	12(+)	16(+)	21(+)	21(+)	15(+)	22(+)	20(+)	9(+)
Butter futures price, as change from preceding day, lagged 1 day..........	1(+)	17(+)	1(+)	22(+)	15(+)	20(+)	29(+)	19(+)	36(+)	9(+)

See footnotes at end of table.

Continued

Table 7.--Percentage of the variation in daily changes in price of Grade A butter at Chicago which can be explained by variation in selected measures of supply and demand for butter, by marketing seasons, 1947, 1948, 1951 and January-March 1952 1/--Continued

Supply-demand factors	Marketing seasons									
	Winter out-of-storage				In storage			Fall out-of-storage		
	1-2-47 to 4-18-47 (75 days)	1-5-48 to 4-16-48 (72 days)	1-2-51 to 4-13-51 (71 days)	12-31-51 to 3-28-52 (62 days)	4-21-47 to 8-22-47 (88 days)	4-19-48 to 9-17-48 (107 days)	4-16-51 to 9-14-51 (107 days)	8-25-47 to 1-2-48 (88 days)	9-20-48 to 12-31-48 (71 days)	9-17-51 to 12-28-51 (70 days)
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Deviation between futures market and cash market, plus estimated cost of storage....................	2/	2/	2/	5(-)	3(+)	1(+)	1(-)	8(+)	3(-)	5(-)

"a" indicates less than 5 percent.

1/ Percentages are coefficients of determination, that is, the squares of the simple correlation coefficients. Signs in parentheses indicate the signs of the correlation coefficients.

2/ Not calculated because this factor was not considered to be important during winter out-of-storage season.

Daily trade output

Daily trade output, a derived figure based on daily receipts adjusted for net change in storage movement and in dealers' floor stocks, provided little explanation of day-to-day changes. This factor is often a result rather than a cause of price changes, and it is not surprising that it provided little explanation of price change when treated as an independent variable.

Futures market

As would be expected, happenings on the futures market the previous day explain a much larger part of the day-to-day change in price than any of the other factors discussed. However, this factor is affected by many of the same factors which affect the cash market, and it cannot be considered in the same light as the other independent variables.

Change in Price From Previous Week Explained by Various Factors

Table 8 sets forth the extent to which changes in daily prices from the same day the previous week were associated with changes in various factors. A much larger part of the change in price from the previous week was related to changes in supply-demand factors than was the case with the day-to-day change in price. With the exception of dealers' floor stocks, there was considerable variation in the coefficients between comparable marketing seasons of the different years studied.

Dealers' floor stocks

As in the case of day-to-day price changes, dealers' floor stocks (expressed as a percentage change of 5-day moving average from preceding 5-day moving average) consistently explain more of the change in price from previous week than any other factor analyzed. In the fall of 1947, dealers' floor stocks accounted for 39 percent of the weekly price change, and in most other periods, from 10 to 19 percent of the variation. Production and storage holdings in 35 markets tended to explain a rather substantial part of the change during the fall out-of-storage season but, with few exceptions, relatively little during other periods. Dealers' floor stocks, however, explain a considerable part of the change during each marketing season, and particularly during the in-storage season, a season when other factors provide very little if any explanation of the week-to-week changes which occurred.

Production

Weekly estimates of butter production for the United States explained 29 and 24 percent of the week-to-week change in price in the fall out-of-storage seasons of 1947 and 1951 (when expressed as a percentage change in annual rate). Butter production in Wisconsin explained 24 percent of the change during the winter out-of-storage season of 1947, and 5, 4, and 9 percent of the change during the same period in 1948, 1951, and 1952, respectively.

Table 8.--Percentage of the variation in weekly changes in price of Grade A butter at Chicago which can be explained by variation in selected measures of supply and demand for butter by marketing seasons, 1947, 1948, 1951, and January-March 1952 1/

Supply-demand factors	Marketing seasons									
	Winter out-of-storage				In storage			Fall out-of-storage		
	1-2-47 to 4-18-47 (75 days)	1-5-48 to 4-16-48 (72 days)	1-2-51 to 4-13-51 (71 days)	12-31-51 to 3-28-52 (62 days)	4-21-47 to 8-22-47 (88 days)	4-19-48 to 9-17-48 (107 days)	4-16-51 to 9-14-51 (107 days)	8-25-47 to 1-2-48 (88 days)	9-20-48 to 12-31-48 (71 days)	9-17-51 to 12-28-51 (70 days)
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Weekly butter production in U. S., as percentage change from preceding week	19(-)	1(-)	a(+)	5(-)	5(-)	a(-)	a(+)	28(-)	2(-)	10(-)
Weekly butter production in Wisconsin, as percentage change from preceding week	24(-)	5(-)	4(-)	9(-)	8(-)	2(+)	1(-)	21(-)	a(-)	a(+)
Annual rate of U. S. butter production, as percentage change from annual rate for preceding week	8(-)	a(+)	1(-)	1(+)	2(+)	a(-)	9(-)	29(-)	6(-)	24(-)
Five-day moving average of receipts at Chicago, as percentage change from moving average for preceding 5 days	5(-)	2(-)	2(-)	a(+)	9(-)	4(-)	11(-)	2(-)	a(+)	9(+)
Weekly cold storage holdings in 35 markets, as percentage change from holdings for preceding week	6(-)	a(-)	a(-)	a(-)	2(+)	a(+)	5(-)	4(-)	17(-)	19(-)
Five-day moving average of net cold storage movement at Chicago, as change from moving average for preceding 5 days	2(-)	2(+)	a(-)	5(-)	3(-)	a(+)	6(-)	41(-)	3(-)	1(-)

See footnotes at end of table.

Continued

Table 8.--Percentage of the variation in weekly changes in price of Grade A butter at Chicago which can be explained by variation in selected measures of supply and demand for butter by marketing seasons, 1947, 1948, 1951, and January-March 1952 1/--Continued

Supply-demand factors	Marketing seasons									
	Winter out-of-storage				In storage			Fall out-of-storage		
	1-2-47 to 4-18-47 (75 days)	1-5-48 to 4-16-48 (72 days)	1-2-51 to 4-13-51 (71 days)	12-31-51 to 3-28-52 (62 days)	4-21-47 to 8-22-47 (88 days)	4-19-48 to 9-17-48 (107 days)	4-16-51 to 9-14-51 (107 days)	8-25-47 to 1-2-48 (88 days)	9-20-48 to 12-31-48 (71 days)	9-17-51 to 12-28-51 (70 days)
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
5-day moving average of dealers' floor stocks at Chicago, as percentage change from moving average for preceding 5 days	10(-)	10(-)	2(-)	19(-)	17(-)	19(-)	17(-)	39(-)	14(-)	5(-)
Weekly movement into retail channels at Chicago, as percentage change from preceding week's movement	6(-)	2(+)	a(+)	5(+)	1(+)	5(+)	a(+)	a(+)	1(-)	25(+)
Weekly movement into retail channels at Chicago, as percentage change from 4-week moving average	1(+)	6(+)	1(+)	23(-)	a(+)	2(+)	a(+)	1(+)	1(-)	29(+)
5-day moving average of trade output at Chicago, as percentage change from moving average for preceding 5 days	2(+)	1(-)	2(-)	4(+)	a(+)	4(+)	1(-)	19(+)	14(+)	1(+)

"a" indicates less than 5 percent.

1/ Percentages are coefficients of determination, that is, the squares of the simple correlation coefficients. Signs in parentheses indicate the signs of the correlation coefficients.

Cold storage holdings

Storage holdings in the 35 markets explained 17 and 19 percent, respectively, of the change during the fall out-of-storage season in 1948 and 1951, but provided little explanation of change during other periods.

Trade output

The derived trade output figure explained 19 and 14 percent, respectively, of the variation in price from previous week during the fall out-of-storage season in 1947 and 1948, but little explanation in other periods.

Movement into retail channels

Movement into retail channels accounted for little of the change in price, except in the fall of 1951 when 25 percent of the change was explained by this factor. Changes in retail movement and price were highly correlated in the winter out-of-storage season in 1952, but not in the way expected. During this period, the short supply was a dominant factor and price increased as retail movement declined. In this case the influence of price on retail movement was much more important than the effect of retail movement on price.

Receipts

Receipts provided relatively little explanation of change in price from the previous week.

Change in Daily Prices Explained by a Combination of Factors

On the basis of the simple correlation analysis, factors were selected for several multiple regression equations to measure the combined effect of several factors on daily price changes. Three combinations of factors were used, one for each marketing season. Table 9 (Appendix, pages 63 and 64) sets forth the equations for the 10 marketing seasons studied and the statistical explanation of price change which they provide. The equations include as a factor the change in the futures market from the previous day. In the simple correlations it was found that this factor explained more of the day-to-day change in price than any other factor. As has been pointed out, the futures price is affected by many of the same factors as the cash market and for this reason is not truly an independent variable. On the other hand, some of the factors which affect the futures market, particularly that of speculative demand, may be less important in the cash market, and certain factors affecting the cash market, such as dealers' floor stocks, may be less important in the futures market.

The multiple regression equations explain, on the average, about one-fifth of the day-to-day change in price and only about 4 percent more of the day-to-day change in price than is explained by change in the futures price alone.

Winter out-of-storage

During the winter out-of-storage seasons the combined effect of the weekly butter production in Wisconsin, movement into retail channels, change in futures market, and dealers' floor stocks explained 15, 25, 12, and 17 percent of the change in daily prices during 1947, 1948, 1951, and 1952, respectively.

In-storage season

Change in futures, dealers' floor stocks, trade output, and deviation between the futures and cash market as related to cost of storing explain 17, 30, and 15 percent of the change in daily prices during the in-storage seasons of 1947, 1948, and 1951.

Fall out-of-storage season

During the fall out-of-storage season, receipts, futures, floor stocks, deviation of 35 market stocks from expectations, and deviation between cash and futures as related to cost of storing explained 26, 27, and 22 percent of the change in daily prices during 1947, 1948, and 1951.

Change in Price From Same Day of Previous Week Explained by a Combination of Factors

As in the analysis of day-to-day price changes, individual supply or demand factors were combined into multiple regression equations to measure the combined effect of several factors on week-to-week changes in price. The results of this analysis are set forth in table 10 (Appendix, pages 65 and 66).

Winter out-of-storage season

During the winter out-of-storage seasons of 1947, 1948, 1951, and 1952, the combined effect of Wisconsin butter production, movement of butter into retail channels at Chicago, dealers' floor stocks and trade output explained 26, 7, 7, and 69 percent, respectively, of the variation in daily price from the previous week.

In-storage season

During the in-storage season the combined effect of butter production in Wisconsin, receipts, dealers' floor stocks, and annual rate of butter production in the United States explained about 25 percent of the change during each of the years 1947, 1948, and 1951.

Fall out-of-storage season

The five factors, receipts, dealers' floor stocks, trade output, annual rate of butter production, and storage holdings, in the 35 markets explained approximately 50 percent of the change in daily prices from previous week in the fall of 1947 and 1951 and 31 percent of the change in 1948.

PRICE PHASE ANALYSIS

The statistical analysis provided some information about selected factors that were related to short-time changes in price. By observing a few of the major price movements or phases during the period studied, noting particularly factors associated with sharp fluctuations in the market, and following the market reporters' comments, it was possible to learn more about the factors which have influenced these adjustments and the reasonableness of the adjustments made. This technique provides also an opportunity of checking qualitatively some of the relationships indicated by the statistical analysis and also of obtaining information on some of the more subtle relationships which are not measurable statistically.

In the rather detailed commentary which follows, the reader may find it helpful to refer to table 5, page 18; figure 8, page 38; figure 9, page 42; figure 10, page 44; figure 11, page 46; and figure 12, page 50.

January 9-22, 1947

On January 9 the market dropped 2.25 cents after a gradual advance early in the month, and in a period of 10 trading days dropped from 75 to 59.50 cents. This decline was associated with a sharp increase in receipts, increased production, and relatively low retail movement.

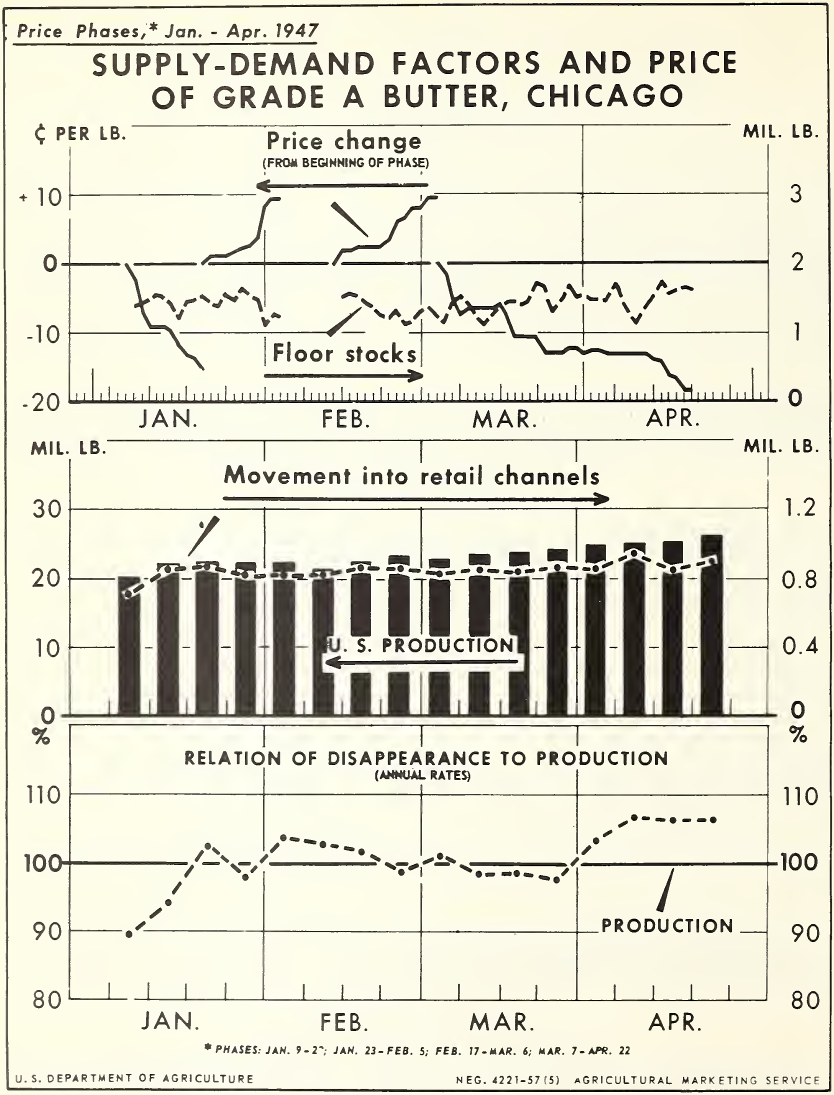
Preceding the decline, very heavy receipts and trade output on January 7 and backing up of supplies on the 8th were notable. Sharp breaks in the New York market on the 10th and 11th were associated with declines at Chicago on the 9th and 10th. Relationships in price between Chicago and New York during the period were very erratic and disruptive, with weakness at New York reported as a dominant factor in forcing values downward at Chicago during the latter part of the period. Market reports indicate a lack of agreement as to values.

Heavy receipts on the 20th and 21st resulted in further declines. However, a lack of willingness to sell at the reduced levels became apparent at the end of the price phase. Heavy movement of butter into storage occurred on a number of days during the price phase indicating an accumulation of supplies.

In light of the supply situation at the time and during the next 2 months, this downward price adjustment was unduly large. The adjustment occurred at a time when a great deal of uncertainty existed as to values.

January 23 to February 5, 1947

During these 10 trading days the market advanced from 59½ to 69 cents. Receipts and trade output figures were very low on the 22d and 23d. Figures



Price Phases, Jan. - Apr. 1947*

SUPPLY-DEMAND FACTORS AND PRICE OF GRADE A BUTTER, CHICAGO

* PHASES: JAN. 9-22; JAN. 23-FEB. 5; FEB. 17-MAR. 6; MAR. 7-APR. 22

U. S. DEPARTMENT OF AGRICULTURE NEG. 4221-57(5) AGRICULTURAL MARKETING SERVICE

Figure 8

indicate a substantial increase in retail movement during the period, which may reflect a response to the sharply lower prices engendered by the previous price phase. Small contraseasonal declines in both the United States and Wisconsin production were notable. Receipts were lower than during the weeks immediately preceding, and movement out of storage increased substantially. Market reports indicate that on January 29 supplies were closely held and dealers anticipated further advances. Weather was an important factor in movement of butter to market, with icy roads reportedly delaying shipments.

The Chicago market advanced 4¼ cents on February 3 following a sharp advance at New York. This sharp price increase was associated with heavy movement of butter out of storage, the second heaviest trade output of the year, and a very low level of dealers' floor stocks. The market advanced further to 69 cents on February 4 on an extremely firm market. The market situation was reported uneasy on February 5 as receipts increased substantially and trade output was again heavy. A 3½-cent decline in price at New York and an accumulation of dealers' floor stocks were factors associated with 1-cent declines at Chicago on February 6 and 7 and an end of the price phase. This price phase appears to represent a reasonable adjustment in the market and in retrospect was made necessary by the fact that the previous downward adjustment in the market had been too severe.

February 17 to March 6, 1947

The downward price phase from February 5 to 14 resulted in a downward adjustment of only 2.25 cents. Supplies were still short and the market tone firm and the trade was willing to hold supplies at existing values. On February 17 the market increased 2 cents and during 14 trading days increased 9.25 cents from the February 14 level. Trade output had been noticeably low on the 14th and 15th. The original upturn was influenced by strength which had been exhibited in the New York market since the 14th.

Retail movement of butter was apparently very satisfactory during this period. Dealers' floor stocks were low at the start of the price phase. The upward price phase was associated with an increased movement of supplies out of storage. Supply and demand appeared well in balance at levels which existed on February 19 and a sharp advance in values in New York was reported as disturbing the Chicago market situation. By February 25 it became apparent that supplies were being closely held; dealers' trading stocks were low, receipts were low relative to the previous week, and movement into retail channels was good. The market advanced 7 cents during the 7 days from February 24 to March 5. A substantial increase in receipts during the first 4 days of the week beginning March 3 and slight accumulation of dealers' floor stocks were associated with a weakened market sentiment and an end of the price phase. Considering that supplies were short, the adjustments during this price phase were reasonable. However, taking place at a time just before the sharp seasonal upturn in production, it was apparent that a declining market was in prospect.

March 7 to April 22, 1947

After reaching a high of 76 cents on March 6, the market declined 18½ cents during the next 32 trading days. Increasing receipts, a slight accumulation of supplies in dealers' hands, and prospects for increasing production weakened market sentiment as the market declined a cent and a half on Friday, March 7, following a 1-cent break in the New York market the same day. Dealers' floor stocks accumulated materially on the 10th and 11th, and the market dropped 6.25 cents during these 2 days. The declines were undoubtedly influenced by equally large declines at New York earlier on those days. Receipts were relatively heavy on these 2 days, but no larger than the bullish market of the previous week had absorbed.

It is interesting to note that the beginning of this sharp decline coincides closely with the beginning of the in-storage season. Very light receipts on the 12th apparently eliminated some of the previous day's weakness and the market rose 1¼ cents. Trade output on this day was notably low and a rather heavy in-storage movement occurred.

During the period March 13th through 18th the market was well maintained, and supplies and demand appeared to be fairly well balanced although an accumulation of dealers' floor stocks on the 18th is notable. Trade output appeared very low on the 18th and 19th. Retail movement up to this point had been apparently fairly well maintained compared with previous weeks although somewhat lower. Receipts were not heavy compared to the previous week. A 1-cent decline at New York on the 19th was followed by a 1½-cent decline at Chicago; and a 2-cent drop at New York the next day was followed by a 3-cent decline at Chicago the same day, as dealers' floor stocks continued to increase. Further accumulation of floor stocks by March 25, along with considerable weakness at New York, was associated with a 2½-cent decline at Chicago on the 26th, although receipts were not heavy relative to the previous week. Indications of continuing increases in production were notable, and the market continued to decline seasonally in response to heavier production and increasing receipts.

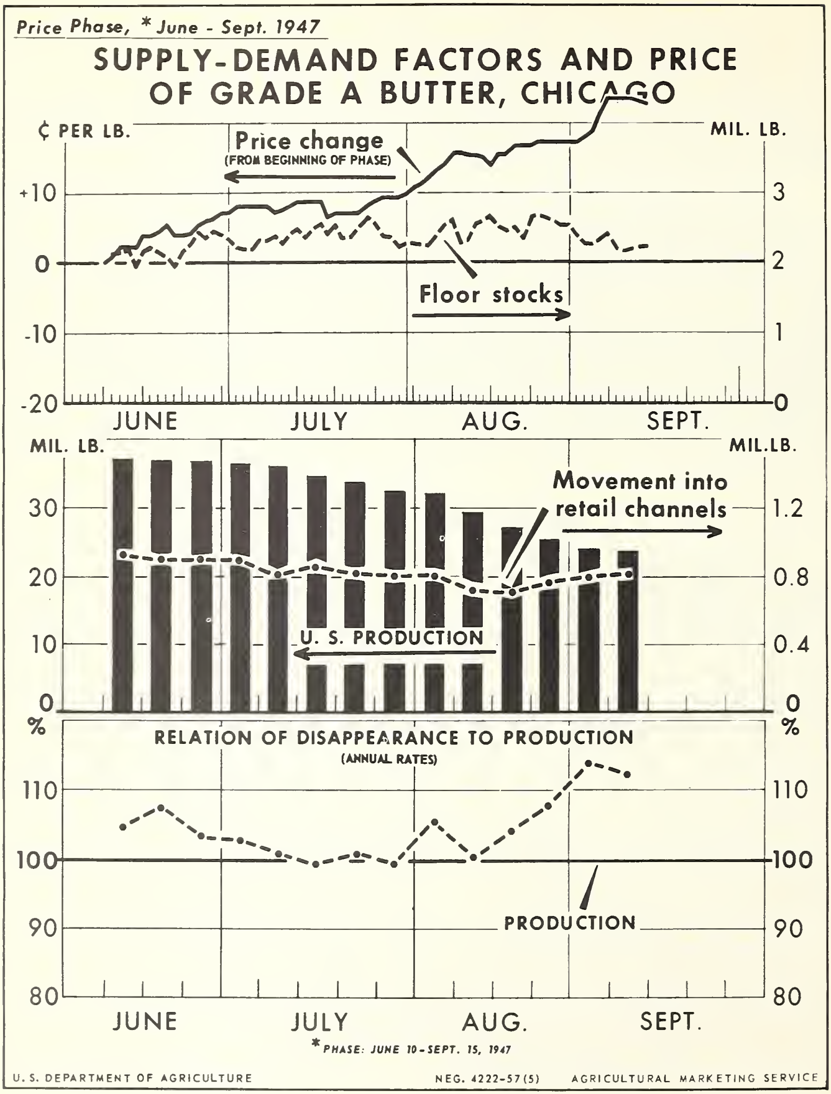
By April 22 the market had declined to 57½ cents, a decline of 18½ cents since March 6. In light of the long-term supply and demand situation, particularly during the last 3 weeks of the price phase when the annual rate of disappearance exceeded substantially the annual rate of production, the extent of the decline seems excessive. The end of the price phase was associated with a contraseasonal decline in receipts during the first 3 days of the week. Substantial increases in retail movement, engendered by the lower level of price, were apparent near the end of the price phase. The market remained relatively steady, advancing slightly contraseasonally from April 23 to June 10 as supplies and demand were fairly well balanced. By the end of May indications were that production was not increasing as much as expected and that an increased demand for butter for storage might be anticipated.

In explaining the behavior of the butter market during the early spring of 1947, the trade attaches considerable importance to the fact that the market had operated from December 1942 until July 1946 under ceiling prices set by the Office of Price Administration. With the removal of price controls after almost 4 years, traders reportedly had lost the "feel" of the market which comes from experience, and they were faced with the substantial changes in demand and supply which had taken place during the war years. During the war, substitutes had made serious inroads on butter consumption because of shortage of butter for civilian use.

On the other hand, after the war, production was considerably below prewar levels and consumer income and savings were at high levels. Also with the end of price controls, substantial changes in the general price level took place. In the mind of the trade and consumers generally, the price of butter 6 months after the end of OPA controls was "astronomical," yet available supplies were clearing the market at that price. Nearly everyone felt that these "high" prices were a short-time phenomena and that prices were bound to become more "normal" soon. For this reason it is understandable that during early 1947, especially, as production increased seasonally, the trade was influenced by the fact that it had been dealing in 40- to 45-cent butter for so long and felt that butter prices would have to decrease substantially, in spite of the high prices late in 1946 and early in 1947.

June 10 to September 15, 1947

The annual rate of disappearance continued to exceed annual rate of production in late May and early June. For the week ending June 9, annual rate of disappearance exceeded the annual rate of production by 13 percent, as retail movement continued good and seasonal increases in production were moderate. Butter production reached its seasonal peak in the week ended June 9. From June 10 to September 15 the market increased 23½ cents, from 59½ cents a pound to 83 cents a pound. A bullish sentiment developed on June 11 in the market as futures advanced sharply and market reports indicated that the demand for cream for ice cream was affecting supplies of whole milk butter. A very heavy in-storage movement is noted early in the price phase, reflecting the strong demand for butter for storage as dealers anticipated increasing values. Declining receipts in the latter part of June and the fact that the annual rate of disappearance continued to exceed the annual rate of production indicate a generally short supply situation as the market advanced steadily during June, held about steady during July, and then advanced 8 cents during August. Retail movement continued at favorable levels through the first week in July but declined noticeably during the second week in July, indicating possibly that the 7-cent increase during June was affecting consumption. Retail movement held about the same during July and dropped off still further in late August. Nevertheless, prices continued to increase as receipts declined. The end of the in-storage season was reached on August 22, and the net movement of supplies of butter was generally out of storage after that date. Under light receipts the market advanced 6½ cents during the first week in September, reaching 83 cents by September 8.


Price Phase, * June - Sept. 1947
SUPPLY-DEMAND FACTORS AND PRICE OF GRADE A BUTTER, CHICAGO
¢ PER LB.
MIL. LB.
Price change
(FROM BEGINNING OF PHASE)
Floor stocks
+10
0
-10
-20
3
2
1
0
JUNE
JULY
AUG.
SEPT.
MIL. LB.
MIL.LB.
Movement into retail channels
U. S. PRODUCTION
30
20
10
0
1.2
0.8
0.4
0
%
%
RELATION OF DISAPPEARANCE TO PRODUCTION
(ANNUAL RATES)
PRODUCTION
110
100
90
80
110
100
90
80
JUNE
JULY
AUG.
SEPT.
*PHASE: JUNE 10 - SEPT. 15, 1947
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AGRICULTURAL MARKETING SERVICE

Figure 9

Weakness in the butter futures market caused agitation in the market on September 12; the long upward price phase ended on September 16 as the market broke half a cent. This contraseasonal upward adjustment was a result of a generally short supply situation and was reasonable. Again, in retrospect it is evident that this large upward adjustment was necessitated in part by the excessive price declines during March and April.

September 16 to October 15, 1947

During the 21-day period the market declined contraseasonally 17 cents. The beginning of this downward price phase is associated with several factors: A contraseasonal increase in receipts during the previous week and a sharp (14 percent) contraseasonal increase in butter production in Wisconsin. The annual rate of disappearance relative to annual rate of production dropped sharply during the week beginning September 15, and by the week beginning September 22 the annual rate of disappearance was running below production. The relation of annual rate disappearance to production worsened in the 2 subsequent weeks and continued well below annual rate production through the week ending October 24, as surpluses moved into storage contraseasonally. Contraseasonal increases in butter production are notable during the price phase. This downward price phase ended on October 16 as receipts declined and a more optimistic trade sentiment was reported. In retrospect this sharp downward adjustment in response to a contraseasonal increase in supplies was much too drastic. Yet with the market at such high levels, an unexpected increase in supplies at this point in the marketing season was bound to depress the market.

October 16 to December 11, 1947

Butter production declined sharply at the start of this upward price phase. In successive weeks, beginning with the week ending October 10, butter production in Wisconsin declined 9, 10, 13, and 21 percent from the previous week. Declines in U. S. production during the same period also were very large. Considerable improvement in retail movement was associated with the 17-cent decline in price which had occurred during the previous price phase. Between October 16 and December 11 the market price increased from 66 cents to 87 cents as the rate of disappearance exceeded rate of production adjusted for storage holdings. During the week of November 17 the market was unsettled as receipts were somewhat heavier than the previous week and dealers' floor stocks increased slightly. On November 21 the market declined 2½ cents. However, with declining receipts and production during the following week, the market advanced 8 cents in the next 9 trading days. The price phase ended on December 12, as increasing production and increasing receipts dampened the bullish sentiment. This sharp upward adjustment again was necessary because of the unduly sharp contraseasonal decline in price from mid-September to mid-October. The level of price established was well maintained through the end of the year.

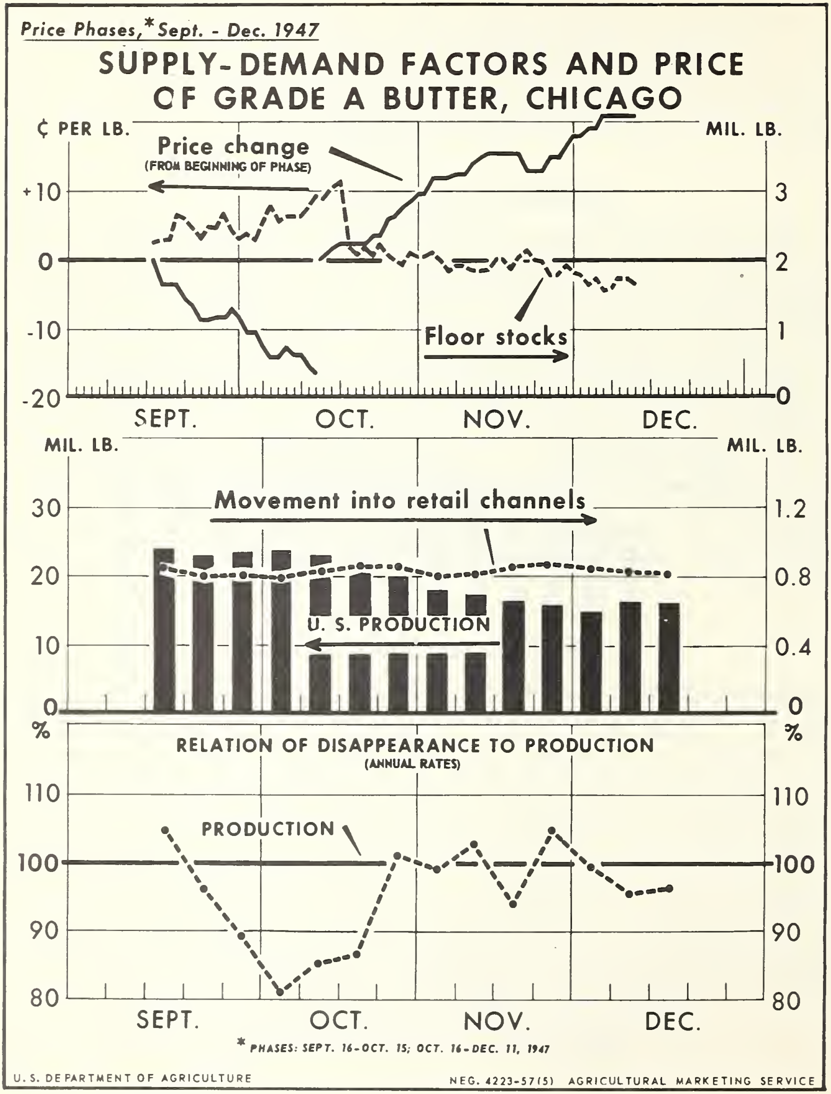
Price Phases,* Sept. - Dec. 1947
SUPPLY-DEMAND FACTORS AND PRICE OF GRADE A BUTTER, CHICAGO
¢ PER LB.
MIL. LB.
Price change
(FROM BEGINNING OF PHASE)
Floor stocks
+10
0
-10
-20
3
2
1
0
SEPT.
OCT.
NOV.
DEC.
MIL. LB.
MIL. LB.
Movement into retail channels
U. S. PRODUCTION
30
20
10
0
1.2
0.8
0.4
0
%
%
RELATION OF DISAPPEARANCE TO PRODUCTION
(ANNUAL RATES)
PRODUCTION
110
100
90
80
SEPT.
OCT.
NOV.
DEC.
* PHASES: SEPT. 16-OCT. 15; OCT. 16-DEC. 11, 1947
U. S. DEPARTMENT OF AGRICULTURE
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Figure 10

January to April 1948

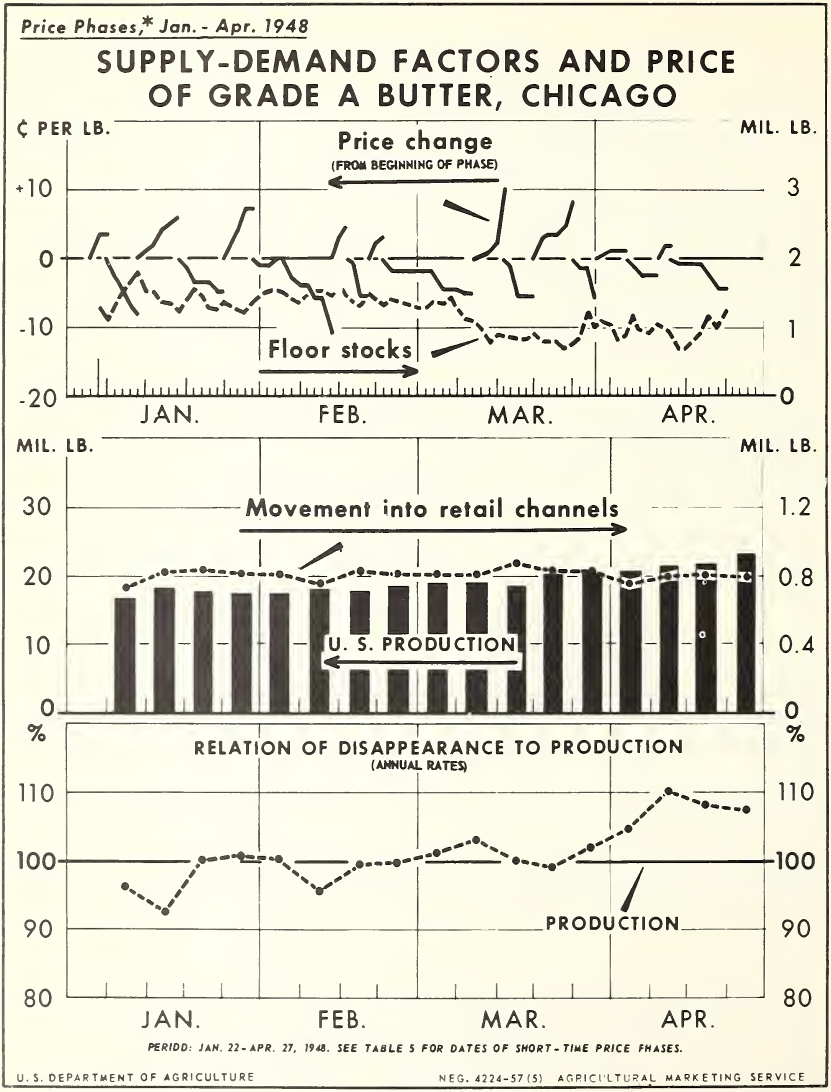
This period represented one of the most erratic and unstable periods in the history of the Chicago butter market. It was characterized by generally short supplies, extremely high prices, and erratic production when the trade was constantly expecting seasonal increases in production; all of this made for a highly nervous market situation. During a great part of the period the market was extremely sensitive to changes in supply, and a great deal of confusion, as to what values should be, was apparent. The supply situation was such that the scramble to obtain supplies to meet distributive needs at times appeared to overshadow everything else, and price was often a minor consideration. Yet, with prices at such high levels, indications of increasing supplies often sent the market sharply downward. A general unwillingness to store short-time supplies existed because of the extremely high prices and the fact that in the late winter period supplies are expected to increase seasonally.

During this period intermarket price relationships were particularly important. Erratic price changes at New York added constant disturbance to the Chicago market. Demand for butter to meet outstanding commitments on the January and February futures contracts was reported as being a further disrupting factor near the close of the contract periods.

The extremely variable supply situation during this period, when the market was particularly sensitive to supply changes, and an erratic retail movement pattern, engendered by sharp price oscillation, were key factors in explaining the extreme instability which existed.

The market for Grade A butter had reached a high point of 88 cents on January 5, 1948, reflecting a generally short supply situation. During the last week in December there had been evidence that production in Wisconsin was increasing and also that the total estimated supply (based on rate of production adjusted by storage holdings) was in excess of estimated rate of disappearances. The January 6 production report for the week ending January 1 showed a 16-percent increase in production in Wisconsin over the previous week, and a 5-percent increase in total production. A heavy out-of-storage movement and a buildup of dealers' floor stocks on January 6 and 7; declines of 2 cents and 1 3/4 cents at New York on the 5th and 6th, respectively; a low post-holiday movement into retail channels; and increased receipts--all were factors associated with declines in the Chicago market of 2 1/2 cents on January 6 and 2 cents, 2 cents, and 1 1/2 cents on succeeding days, a total decline of 8 cents in 4 days.

By January 9 there was an indication of a change in sentiment on the part of some dealers, and dealers' floor stocks had declined somewhat. The New York market advanced 2 cents on Monday, January 12, and the Chicago market followed with a 1-cent advance the same day. The market at Chicago advanced 5 cents more during the week, as receipts continued light and dealers' floor stocks declined.



Price Phases, Jan. - Apr. 1948*

SUPPLY-DEMAND FACTORS AND PRICE OF GRADE A BUTTER, CHICAGO

*PERIOD: JAN. 22 - APR. 27, 1948. SEE TABLE 5 FOR DATES OF SHORT-TIME PRICE PHASES.

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Figure 11

Sharp declines at New York on January 19 and 20 were accompanied by declines at Chicago as receipts increased slightly and floor stocks accumulated. This occurred at a time when the production report on January 20 indicated a rather sharp contraseasonal decline in total production. A further decline in price occurred on January 23, in spite of the fact that receipts were low relative to the previous week.

The market advanced 7 cents during the 3-day period, January 27, 28 and 29. This increase was associated with sharp increases at New York on those days. Reported receipts were lighter than expected, dealers' floor stocks declined, and the Tuesday (January 27) production report indicated a further contraseasonal decline in already low levels of production. The following comments of the Chicago Price Current market reporter on January 29 indicated the confusion in the market at the time.

> "The butter market continues to soar high into the stratospheric realm of the unknown climes of relativity--where only an Einstein can calculate the final result. Bids posted on the Mercantile Board today were numerous with little or nothing in the way of supplies to be had to satisfy the demands, so, as a result, a follow up of increased prices had to be recognized for what they signify. In New York, the same atmospheric conditions prevail up 3 cents at the time this report was being written, so all in all Chicago is not too far out of line in the way of high prices. Most dealers recognize this precarious condition for what it is but seem to be helpless in the onslaught. Frantic activity seems to abound, which knows no limit, and it seems that the issue will be carried to the ultimate consumer, where these prices will either be accepted reluctantly or otherwise, higher prices and astronomical figures notwithstanding."

Receipts increased during the week of February 2, and dealers' floor stocks tended to accumulate; however, a 2 3/4-cent increase at New York on February 4 appeared to influence sentiment at Chicago and the market advanced 1 cent. On February 6 the market declined 3 cents. Receipts for the week were moderately in excess of those for the previous week, and the market was reported to be very nervous and influenced by sharp declines in prices of other agricultural commodities. The market declined 8 cents the following week (February 9-13). This was associated with a 5-percent increase in U. S. production; however, receipts at Chicago remained light and total storage holdings were extremely low (about a 1 day's supply). A drop of 6½ cents at New York on the 12th was a significant factor in the market during this period. Retail movement of butter, which had been holding up relatively well considering the high level of prices, showed a marked decline about this time.

The extreme declines at New York and Chicago on the 12th and 13th, were offset by sharp increases in price in both markets on Monday and Tuesday (February 16 and 17) of the following week in spite of increased receipts. On February 19, sparked by a decline of 4½ cents at New York earlier in the day, the Chicago market declined 5 cents, in the face of slightly heavier receipts and reported sharp decline in retail movements. This sharp decline was followed by a 3-cent increase on Tuesday and Wednesday, the 24th and 25th, as receipts declined and a 2-cent decline on Thursday, when the New York market also declined 2 cents.

The market was operating on a day-to-day basis, and any change in supply, however small, apparently had an exaggerated effect on price, as dealers depended upon the mechanism of price to avoid any accumulation of supplies over day-to-day distributive needs.

The market continued on a very nervous basis through the rest of February and the first few days of March. The production report available to the trade on February 25 indicated a 2-percent increase from the previous week and the report issued on March 2 indicated a further increase of 4 percent. Storage holdings of butter were still extremely low in Chicago and throughout the country. Indications of the long-expected seasonal upswing in production and a $3\frac{1}{2}$-cent decline in price at New York during a 5-day period, which the Chicago market had not followed, were associated with a $2\frac{1}{2}$-cent decline in the market on March 5, to $74\frac{1}{2}$ cents per pound. On March 15 total storage holdings in Chicago were only 271,000 pounds (much less than an average day's receipts).

The production report issued on March 9 showed no increase in production over the previous week, and the report issued on March 16 indicated that production had declined contraseasonally 2 percent. Receipts of butter on March 15 and 16 were lower than the previous week as the market advanced 1 cent; on March 17 the market rose 8 cents in face of sharply lowered receipts and a 5-cent increase at New York. Dealers' floor stocks at Chicago were extremely low. Here is how the Chicago Price Current market reporter described the situation on March 17:

> "Market really went crazy today. All dealers were extremely bullish and evidently price was a secondary matter. Prices bid and the manner in which dealers went after stock indicated possibly that the supply of butter had disappeared. On the Exchange today, closing activities reflected a willingness to take on the various grades at the sharply higher prices listed, and in this connection mention should be made of the fact that even the higher bids failed to attract selling."

Price relationships between Chicago and New York were a very disruptive factor during this period. At times, Chicago was as much as 6 cents lower than New York, at other times as much as 2 cents higher. The two markets fought for the inadequate supplies available and one market reflected the extreme day-to-day changes in the other market. This seems to have kept the market constantly out of balance. With only one market as the source of price quotations, it would have been extremely difficult to expect much stability in price during the period, supply conditions being what they were; with two markets the irritations resulted in virtual chaos in the price establishing system.

The market continued the same highly erratic pattern during the next 2 months as supplies remained short, expected increases in production failed to materialize, receipts remained variable, and intermarket price relationships continued to be erratic. Table 5 shows the sequence of price phases and the extent of the fluctuation which occurred.

While the matter of establishment of butter prices had come in for criticism from time to time in earlier periods, it was during this chaotic period in the late winter of 1948 that a number of persons in the dairy industry expressed considerable concern about the manner in which central market butter prices were established.

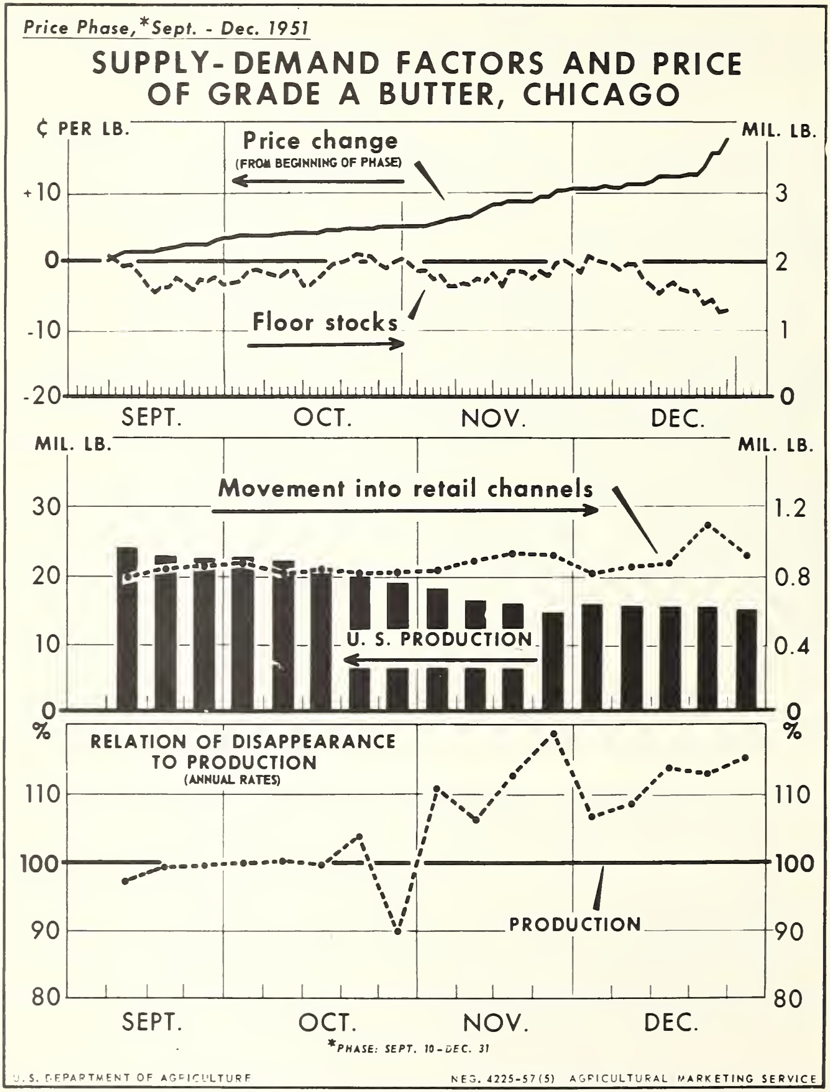
September 10 to December 31, 1951

The longest price phase during the period studied, and one of gradual adjustment in price, occurred during the fall of 1951, a period when butter supplies became increasingly short. Prices had rested at close to Commodity Credit Corporation support levels during the in-storage season. During most of the first 9 months of the year the rate of disappearance had exceeded the rate of production, indicating that prices during this time might be lower than supply-demand conditions warranted. However, after 2 years of heavy surplus, prices tended to seek a level approximately equal to announced Government support levels during the in-storage season and the price floor tended to become also in effect a price ceiling, in spite of indications that the annual rate of disappearance was outrunning the annual rate of production. Legislation which repealed the New York and Illinois State taxes on colored oleomargarine effective July 1, 1951, is frequently mentioned as a weakening factor during the heavy production months of May and June. Uncertainty about the effect of this action on butter consumption made many receivers reluctant to accumulate large supplies of storage butter. Apprehension about the effect of imported butter was also reported as a factor in the weakness of the market in the face of a disappearance rate which was consistently outrunning the annual rate of production.

Information obtained in the market indicated that the bulk of storage butter held for other than receivers' own distributive needs was in the hands of a relatively few Chicago receivers.

The market advanced one-half cent on September 11, 1951, and by the same amount September 12; this started an advancing price phase which lasted 75 trading days ending on December 31. Only one downward price adjustment occurred during the entire period, and that only a $\frac{1}{4}$-cent change. During the price phase, prices advanced $17\frac{1}{2}$ cents, from $65\frac{1}{2}$ to 83 cents per pound. The beginning of the advancing price phase was associated closely with the beginning of the fall out-of-storage season on September 18.

During this price phase the price advance was gradual; nearly half of the advances were only one-fourth of a cent from the previous day. During 1948 the price changed from the previous day by as little as one-fourth of a cent



*Price Phase,*Sept. - Dec. 1951*

SUPPLY-DEMAND FACTORS AND PRICE OF GRADE A BUTTER, CHICAGO

*PHASE: SEPT. 10 - DEC. 31

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Figure 12

only once in 257 trading days. During 1949 and 1950 and for a good part of 1951, the market rested on or close to CCC buying prices. With this background of stability in mind price changes of one-half or three-fourths of a cent from the previous day were considered as substantial and reflective of a very strong market; whereas in the late winter and early spring of 1948 when daily changes of 2 or 3 cents a pound were commonplace, a change of only one-half cent per pound was often an indication of stability rather than change.

This consistent upward price movement was associated with a consistent downward pattern of production. Variability of supply was a big factor in many of the sharp oscillations of the market in 1947 and 1948. Retail movement was relatively steady during this period in 1951; the price increases were so gradual that they did not bring about upsetting short-time consumption responses such as were evident in 1947 and 1948.

Hearsay evidence that the bulk of uncommitted supplies was held by a relatively few receivers tends to be borne out by the nature of the price adjustment; that is, with supplies concentrated in the hands of a few the price is established largely on the aggregate decision of these few as to what they are willing to sell for. With few sellers involved such decisions are more easily reached. It is quite likely that with a more general distribution of the supply of storage butter the upward price movement would have been more erratic. Nevertheless, consistency of the supply-demand situation as the season advanced is the most important factor explaining this long uninterrupted price phase.

When the market is fluctuating violently charges of manipulation are often heard; yet the experience in the fall of 1951 indicates that during a period when supplies were rather closely held the market was extremely stable. This raises the question as to whether a stable market is not more indicative of control of supply than a market which is fluctuating.

APPRAISAL

During much of 1947 and 1948 and at times during 1951 and 1952, daily butter prices fluctuated widely. This study sought to examine the nature of these price fluctuations, and to judge whether such fluctuations were reasonable in terms of short-time changes in supply and demand. Irrespective of the extent to which short-time changes in price could be explained by changes in supply and demand, consideration also was given to whether short-time fluctuations in the price of butter were such that they would interfere with the orderly marketing of milk and dairy products.

Results of Statistical Analysis Inconsistent with Others' Observations of Market

An analysis of the USDA or commercial market reporter's daily butter market comments indicates that daily changes in price are rather consistently explained in terms of changes in supply and demand. For example, only 2 out of 86 times during 1947 did an increase in price occur at a time when supplies were reported as ample to heavy or heavy. The market reporter indicated supplies were moderate or light 77 of the 86 times when the price increased. Likewise, only 4 out of the 52 times the market declined in 1947 were supplies reported as light, and the majority of decreases occurred when supplies were reported either as adequate or ample to heavy. Market reporter's comments as to demand likewise are consistent with the movement of prices. Of the 52 price declines which occurred in 1947, 46 occurred when demand was reported light or very light. Of the 89 times price increased, only 19 occurred when demand was reported very light or light.

Conversations with major receivers of butter and others familiar with the market indicate that they feel that the market is very sensitive to changing supply and demand situations and that published information on supply and demand and other indications of changes in supply or demand are followed closely. Indications are that it is extremely difficult for an individual to maintain, for more than a short time, prices out of line with a level which the trade believes supply-demand conditions indicate (3, p. 48).

Observation of the major price movements which occurred during the period studied indicates that these price movements were generally associated with changes in supply and demand. Also, the direction in which the market moved was generally consistent with changes in supply and demand, although the extent of the adjustments were often excessive in light of subsequent developments in supply and demand.

The statistical analysis, on the other hand, indicates that much of the time relatively little of the change in daily butter prices can be explained by changes in published supply and demand information, although it does indicate that generally the relationship is such that the direction of change indicated by the regression coefficients is consistent with changes in supply and demand. The relationship indicated by the statistical analysis is, in many cases, so small that it creates serious conflict between other observations of the market's behavior and the results of the analysis; and it raises the question as to possible explanations of the inconsistency between the statistical analysis and other observations of the apparent responsiveness of the market to changes in supply and demand.

Statistical analyses have been made, covering several other commodities, of the relationship between short-time price changes and changes in supply and demand. The findings have tended to show little, if any, relationship between short-time changes in supply and demand and price (10, pp. 19-23). This may be interpreted as indicating that for the various commodities studied, there is little relationship between short-time changes in supply and demand and short-time changes in price, or it may be indicative of the inability of statistical techniques used to describe and measure accurately the complex relationships involved.

The following are some of the possible reasons that the results of the statistical analysis used in this study fail to corroborate the market reporters' comments and other observations of the responsiveness of the market to changes in supply-demand conditions:

1. The analysis expressed some of the supply and demand factors in measures such as percentage change from previous week or previous day and others in terms of actual change. Supply or demand as it affects the market is more than an absolute number of pounds or a percentage change. It is also a matter of how loosely or closely this supply is held. That, in turn, is dependent upon price. For example, production may increase 5 percent from one week to the next; however, if price has declined 7 cents during the week, the demand for this 5 percent greater production may be heavy, and the supply in terms of any surplus or accumulations in dealers' hands may be extremely light. In other words, volume of stocks, production, receipts, and other factors affect the market in relation to price and not independently, as our analysis presumes.

Many of the price adjustments that take place in the market are readjustments that result because prices declined "too much" or advanced "too much." It is at such times that price exerts relatively more influence as an independent variable, than as a dependent variable as we presume in the statistical analysis. The statistical analysis assumes the market to be in equilibrium at any particular time (for instance, at the end of a day's trading) and presumes adjustments always are to be made from a market which is in equilibrium. Actually, many times price adjustments arise not because of specific changes in physical measures of supply or demand, but from a growing sentiment in the trade that the market has advanced "too far" or declined "too much."

The analysis also assumes a linear relationship between changes in supply-demand factors and price. 5/ It presumes a unit change in supply and demand factors to be associated with unit changes in price. Such a relationship is assumed because of lack of any specific evidence that nonlinear relationships generally exist, although it is known that at certain times both the supply of and demand for butter at wholesale is extremely inelastic, and at other times extremely elastic. The extent to which the nature of the relationship between price and changes in the supply or demand factors is nonlinear affects the relationships found.

2. Inability to take into consideration information in the hands of the trade other than published supply-demand information, problems of timing of cause-effect relationships, means of expression of factors, and inability to express statistically the cumulative effect of a number of factors on a given market situation--all limit the extent to which the realities of the market place may be handled statistically with confidence.

5/ Some of the factors consist of the original supply-demand data, but in other cases data are expressed as percentage changes from previous day or previous week, or from moving averages equivalent to a curvilinear relationship in the original data.

With the factors used and the method of analysis followed, relatively little of the day-to-day change in butter prices could be associated statistically with short-time changes in supply and demand. The results of the statistical analysis do not provide basis for inferring that, in generally reporting a close relationship between short-time changes in supply and demand and price, the market reporter is incorrectly appraising the situation, or that the market is not responsive to what the trade feels supply-demand conditions to be.

Butter Prices Inherently Unstable

The analysis suggests that at times butter prices tend to be inherently unstable because of the nature of the product and the manner in which it is marketed. Several factors appear to contribute to the inherent instability:

(1) Butter, occupying the position that it does as a balance wheel in the dairy economy, is at times subject to variations in production many times greater than fluctuations in overall milk production. When surpluses of milk develop, a great deal of the overall dairy surplus is channeled into butter; and likewise as shortages develop, large quantities of milk may be diverted from butter to other uses.

(2) The exaggerated price responses engendered because supply and demand are extremely inelastic under certain conditions, tend to induce responses in demand and supply throughout the marketing system creating further imbalance.

(3) Buying and selling on the basis of the quotation tends to reduce the amount of bargaining between buyer and seller, to delay necessary price adjustments, and to restrict the movement of supplies between markets in response to price changes. For instance, retail and jobbing buyers, when prices get to a point where they consider that there is more chance of prices going down than going up, may restrict purchases and buy on a day-to-day basis rather than bargain for a lower price. This tends to delay price changes and probably to make the changes more severe when they come. After the sharp break has come, a period of heavy buying may follow to again fill the pipelines of distribution.

(4) With 85 to 90 percent of the butter marketed being bought and sold on the basis of a fixed differential relative to a central market quotation, many large distributors seem more concerned with margins relative to the quotation than in the level of the quotation itself. These distributors are relatively indifferent to the level of price as such and do not participate directly in the trading which provides the basis for establishing the quotation. Thus, direct participation in day-to-day price determination is left to a relatively few dealers who buy others' surpluses and sell bulk butter to those who need supplies.

Excessive Instability Undesirable

Excessive short-time price fluctuations increase marketing risks and marketing costs. They disrupt orderly and efficient marketing and are contrary to the interest of the producer, the consumer, and the distributor alike.

The Chicago butter quotation has the characteristics of a national measure of butter values and is so used in paying creameries and in pricing fluid milk and cream throughout the country. The New York butter market quotation is an important indication of butter values in the eastern part of the country and is also widely used as a basis for settlement between receivers and creameries. Such measures of value are needed. The significance of the Chicago and New York butter quotations makes it desirable that short-time oscillations such as occurred in 1947 and 1948 be minimized.

Means by Which Price Fluctuations Might Be Minimized

At present (May 1957), with butter prices resting firmly on Government support levels, it seems almost academic to consider proposals for combating instability in the butter market. 6/ As indicated previously, this work was originally undertaken at a time when instability was the characteristic feature of the market. The study has indicated that the wide fluctuations in butter prices in 1947 and 1948 were generally related to supply-demand conditions but were excessive to the point of being disruptive to the orderly marketing of milk and its products. The same basic trading rules, and, though dormant, the same potential sources of instability exist today as existed then.

Limitation on amount of change on any one day

There are several ways by which the disruptive short-time price oscillations might be minimized. One would be to limit the amount of price change on transactions on the mercantile exchanges on a particular day to a certain maximum, say 1 cent. This would tend to get at the source of one of the important causes of fluctuation, over-response to apparent short-time changes in supply and demand. At times such a restriction might actually cause more day-to-day price changes, but it would tend to temper the size of the changes. It would control, at the source, excessive short-time changes in prices which eventually cause excessive readjustments, and which also create unstabilizing responses in both supply and demand.

Such a limitation would assure traders that prices would not change drastically from day to day. There would be less tendency, as the market weakened after a period of rising prices, for dealers to flood the market with

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6/ However, as an indication that instability of butter prices is still of concern to the dairy industry, see "The Why and How of the Self Help Program" (4, p.8).

supplies, or, on a strong market, for dealers to hold supplies back in anticipation of sharply higher values a day or two hence. Because adjustments in price would be more gradual, disruptive short-time supply responses would be less likely to occur.

Limits similar to this presently apply to trading on several commodity exchanges. 7/ Such a restriction on the mercantile exchanges probably would be looked upon with disfavor by some, who would argue that at times it is necessary that the market move faster than the limits would permit.

Excessive adjustments to changes in supply-demand conditions appear to have caused much of the instability in the market during the period studied, but such disruptive adjustments are relatively infrequent. During 1947 and 1948, the price changed from the previous day by more than 1 cent about 35 percent of the time, but only 4 percent of the time in 1951. With a limitation on the daily price change, it is likely that sharp readjustments would not be needed because the limitation would prevent at the outset excessive price responses which occasion the need for sharp readjustment.

It would be important that any limit established be large enough to permit reasonable adjustment of prices to changing market conditions and not so rigid as to discourage trading on the exchange.

The 1-cent limit would apparently not be restrictive to the point of preventing rapid enough adjustment in the market to changing supply-demand conditions. To assure that the limit established would not be unduly restrictive at times, the butter rules committee or some other governing body should have power to increase the permissible daily price variation, if an emergency should justify such action.

Establishment of weekly prices by industry committee

Spot cotton prices are presently reported by industry quotation committees. These committees are appointed to report prices at "bona fide cotton markets." These markets are located at strategic points where cotton is traded in sufficient volume and often enough to provide a basis for price determination. Actual sales, bids, and offers are considered by each committee in arriving at its conclusion as to the prices of various grades and staples in their area. The setting up of an industry committee to establish

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7/ The New York Cotton Exchange limits daily changes in cotton futures to a maximum of 2 cents; the Chicago Mercantile Exchange limits daily changes on butter futures to 3 cents, up or down; daily changes in egg futures at Chicago and New York are limited to 2 cents, up or down, and the Chicago Board of Trade limits daily changes in wheat futures to 10 cents, up or down. A number of other commodity futures markets establish limits as to the amount prices may change from one day to the next. Such limits generally have not been established for cash commodity markets.

or report weekly butter price quotations has been suggested (6, pp. 93-191). It might provide an acceptable solution to the problem of unstable butter prices except for a distrust of arrangements which depend on decisions by a few individuals, in contrast to more impersonal market mechanisms. Special legislation probably would be required if such a method were to be used.

Increasing volume of trading on mercantile exchanges

If the spot butter markets of the mercantile exchanges would more adequately serve as a market place for the limited open-market trading which takes place, a broader basis would exist for quoting the market. An increased volume of trading would tend to minimize the effect of individual transactions and to reduce the size and number of daily price fluctuations. The Chicago and New York mercantile exchanges might broaden their function as market places if certain changes were made in the rules for spot butter trading:

1. Make it possible for receivers to offer butter on the spot call at various country concentrating points outside of Chicago or New York.

2. Provide a fuller description of butter offered on the exchange, including such factors as salt and color.

3. Require the buyer to pay the seller a receiving and handling allowance for butter purchased on the spot call.

APPENDIX

Problems Involved in Setting up Statistical Analysis

In measuring the relationship between various factors and price, a number of problems arose with respect to the manner of expressing the various measures of supply and demand, and timing cause-effect relationships.

Prices used

The analysis was set up to measure the effect of changes in supply and demand upon price. Prices are quoted for 6 descriptions of butter at Chicago and 4 grades at New York. It was necessary to decide whether to analyze more than one market and more than one grade of butter. It is known that while prices of the various grades and in the various markets tend to move up and down together, there are times when they do not. At times supplies of particular grades are burdensome, while other grades are scarce. However, since supply-demand information is not available on a grade basis, it was necessary to limit the analysis to what is considered the most representative grade pricewise, Grade A.

Because of the large amount of data involved it was decided to use prices for only one market in the analysis. The Chicago market was chosen because it is less dominated by strictly local price factors. Price quotations issued in Chicago Price Current were used inasmuch as these quotations are used predominantly by the traders in the Midwest for buying and selling purposes.

It was necessary to decide whether to work with actual prices or a measure of change in price. Since emphasis was to be placed on matters of short-time price change, it was decided to use changes from previous day and from previous week rather than to use actual daily prices in the analysis. Expressing prices in terms of change eliminated the element of price level from the analysis.

Means of expressing factors

Numerous problems were encountered in the method of expression and timing of the various supply and demand factors used. For example, weekly butter production data can be expressed in a number of different ways. In interpreting the significance of the amount of butter produced, it is necessary not only to consider total pounds produced, but to relate the current week's production to production during the previous week and to average weekly production for recent weeks. In addition, the current week's production may be related to production the same week a year ago or to a 5-year average for the week, or to some other base.

The problem is further complicated by the fact that butter production from week to week follows a more or less predictable seasonal pattern so that at certain times of the year production is expected to increase from the previous week and at other times to decline. A 5-percent increase in production at a time when production normally increases by that amount would be expected to have a different effect upon the market from a 5-percent increase at a time when production normally declines 2 percent. For this reason it is unrealistic merely to consider changes in production; it is necessary also to consider changes in relation to dealers' expectations as to changes in production. However, certain problems arise if adjustment is made for expectations, inasmuch as these expectations themselves represent important changes in market conditions. For example, an "expected" decline in production, as well as an actual decline, might result in an increase in price.

Timing of cause-effect relationships

The formulation of hypotheses relating to the effect of production and other factors upon price is difficult because of the problem of timing cause-effect relationships. For example, the weekly butter production report is available to traders at 9:00 a.m. on Tuesdays (before the opening of the Tuesday spot-call at the New York Mercantile Exchange and at the Chicago Mercantile Exchange) and would be expected to exert more influence upon trading on Tuesday than on any other single day. But the weekly butter production report is not the only source of information as to what is happening to butter production. Dealers frequently talk with managers of creameries which ship them butter and with their representatives in the production area. From such conversations the dealers may get almost daily impressions as to what is happening to production. Daily receipts of butter also indicate changes in production. Therefore, before the production report is issued dealers will have formed a more or less accurate idea of what the report will show. This will have affected in turn: Their judgment as to market conditions; their actions in the market; and the trend of prices. If production developments are discounted considerably before the report becomes available, the influence of the report depends on how closely it corresponds with the trade's appraisal of production conditions.

On the other hand, the Tuesday report on production during the previous week would also be expected to affect dealers' opinions as to market conditions on subsequent days after the day of issue until the next production report is issued.

Production information was used as an example of the type of problem involved in expressing various supply-demand factors and in timing the impact of such factors upon day-to-day price changes. Many of the same general type of problem existed for nearly all other factors, available only on a weekly basis. Timing was less of a problem with respect to supply-demand information available on a daily basis.

For all data available only weekly, the weekly figure was carried for the day available and for each subsequent day until the next report was issued.

This approach assumed, in effect, that the information in the weekly report would be given equal weight on subsequent days as on the day of issue. This method was chosen as the most acceptable way of handling weekly data after examining various possible alternatives. For various factors available on a weekly basis, analysis was made to determine whether the amount of variation explained on the date of availability was significantly different from that on other days of the week. This analysis indicated that such factors explained no more of the variation on the day the information first became available than on subsequent days until the next report was issued.

The matters of expression and timing create serious problems as far as statistical analysis of the effect of various supply-demand factors upon daily butter prices is concerned. In setting up various relationships, data were often expressed in several different ways; and in many cases, several different assumptions have been set up with respect to timing of the cause-effect relationship (that is, the independent variable has been lagged or advanced in various ways). Week-to-week price changes as well as daily changes were also analyzed. The matter of timing of cause-effect relationships was less of a problem when week-to-week price changes were used.

Problems of cause and effect

Under certain situations price may be a cause of changes in some of the indicators of supply and demand, as well as a result of these factors. For example, dealers are constantly evaluating the current price in terms of their estimates of what the market is likely to be tomorrow, next week, or next month, or 3 months hence. As price increases or decreases it immediately affects the willingness of dealers to buy or sell. For instance, often on a rising market a stage is reached where dealers become increasingly less willing to accumulate supplies because they feel that the market may be too high, and short-time surpluses may result; conversely, on a declining market prices may decline to the point where dealers feel the market is too low, and their willingness to store will cause short-time shortage. Ideally the analysis should recognize this fact. But practical difficulties limit severely the extent to which situations in which price is a cause can be distinguished from those in which price is an effect. This led to the conclusion to treat price as the dependent variable at all times. This is a serious deficiency and undoubtedly leads to an underestimate of the amount of price change which could be explained by changes in certain factors.

Seasonal factors

Certain supply factors seem to influence price more at certain times of the year than at other times, particularly production and stocks (5). Recognition of such situations, many of which are seasonal in character, is essential if the correlation analysis is to be descriptive of the market. By making the analysis on the basis of marketing seasons, it was hoped to minimize such problems.

The problems encountered in setting up the statistical analysis are similar to those faced by dealers in evaluating day-to-day changes in market conditions. They indicate the complexity of the judgments traders in the central markets must make as to changes in supply-demand conditions during the process of "price discovery."

Multiple Regression Equations

Two sets of multiple regression equations were calculated, one relating to daily price changes and one to weekly changes in prices. Each set consisted of 10 equations, 1 for each marketing season. All of the equations were of the form:

Price change = constant term + $b_1X_1 + b_2X_2 \ldots b_nX_n$, where the b's represent net regression coefficients and the X's represent supply-demand factors. For example, from table 9 (pp. 63-64) the equation expressing daily price change during the first fall out-of-storage season (August 25, 1947 to February 2, 1948) is:

$$\text{Daily price change (in cents)} = 0.0950 - 0.0025X_1 + 0.2498X_2 - 0.0161X_3 + 0.3453X_4 + 0.1798X_5,$$ where,

X_1 = Daily receipts at Chicago adjusted for variation within week, as percentage change from moving average for preceding 5 days

X_2 = Weekly cold storage holdings in 35 markets, as percentage change from expected holdings

X_3 = Daily dealers' floor stocks at Chicago, as percentage change from moving average for preceding 5 days

X_4 = Butter futures price, as change from preceding day

X_5 = Deviation between futures market and cash market, plus estimated cost of storage

The standard error of the estimated daily price change = ±0.934 cents. The coefficient of multiple determination, that is, the square of the coefficient of multiple correlation, or the percentage of the variation in daily price associated with variations in the selected supply-demand factors = 26%.

From table 10 (pp. 65-66) the equation expressing the weekly price change during the third winter out-of-storage season (January 2, 1951 to April 13, 1951) is:

Weekly price change (in cents) = $-0.3334 - 0.0724X_1 - 0.0228X_2 + 0.0173X_3 - 0.0090X_4$, where,

X_1 = Weekly butter production in Wisconsin, as percentage change from preceding week

X_2 = Five-day moving average of dealers' floor stocks at Chicago, as percentage change from moving average for preceding 5 days

X_3 = Weekly movement into retail channels at Chicago, as percentage change from 4-week moving average

X_4 = Five-day moving average of trade output at Chicago as percentage change from moving average for preceding 5 days

The standard error of the estimated weekly price change = ±1.069 cents. The coefficient of multiple determination, or the percentage of the variation in weekly price change associated with variations in the selected supply-demand factors = 7%.

Table 9.--Multiple regression equations: Constants and net coefficients (average amount of increase or decrease in daily change in price of Grade A butter at Chicago which occurs with each increase of one unit in selected supply-demand factors), standard errors of estimate, and percentage of variation in daily price change associated with variation in combination of factors, by marketing seasons, 1947, 1948, 1951, and January-March 1952

Item	Marketing seasons									
	Winter out-of-storage				In-storage			Fall out-of-storage		
	1/2/47 to 4/18/47	1/5/48 to 4/16/48	1/2/51 to 4/13/51	12/31/51 to 3/28/52	4/21/47 to 8/22/47	4/19/48 to 9/17/43	4/16/51 to 9/14/51	8/25/47 to 1/2/48	9/20/48 to 12/31/48	9/17/51 to 12/28/51
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
Constant term of multiple regression equation for marketing season	0.0162	-0.2149	-0.0101	-0.1291	0.1040	0.0344	0.0169	0.0950	-0.4362	0.1215
Supply-demand factors 1/	Net regression coefficients									
Weekly butter production in Wisconsin, as percentage change from preceding week (2)	- .0634	- .0312	- .0114	- .0309	---	---	---	---	---	---
Daily receipts at Chicago adjusted for variation within week, as percentage change from moving average for preceding 5 days (4) ..	---	---	---	---	---	---	---	- .0025	- .0046	.0034
Weekly cold storage holdings in 35 markets, as percentage change from expected holdings (6)	---	---	---	---	---	---	---	.2498	- .1825	.1085
Daily dealers' floor stocks at Chicago, as percentage change from moving average for preceding 5 days (11)..	- .0316	- .0457	- .0058	- .0324	- .0082	- .0345	- .0085	- .0161	- .0327	- .0024

See footnote at end of table.

Continued-

Table 9.--Multiple regression equations: Constants and net coefficients (average amount of increase or decrease in daily change in price of Grade A butter at Chicago which occurs with each increase of one unit in selected supply-demand factors), standard errors of estimate, and percentage of variation in daily price change associated with variation in combination of factors, by marketing seasons, 1947, 1948, 1951, and January-March 1952--Continued

Item	Marketing seasons									
	Winter out-of-storage				In-storage			Fall out-of-storage		
	1/2/47 to 4/18/47	1/5/48 to 4/16/48	1/2/51 to 4/13/51	12/31/51 to 3/28/52	4/21/47 to 8/22/47	4/19/48 to 9/17/48	4/16/51 to 9/14/51	8/25/47 to 1/2/48	9/20/48 to 12/31/48	9/17/51 to 12/28/51
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
Supply-demand factors 1/	Net regression coefficients									
Weekly movement into retail channels at Chicago, as percentage change from preceding week's movement (13) ..	-0.0187	0.0064	0.0089	0.0092	---	---	---	---	---	---
Daily trade output at Chicago, adjusted for variation within week, as percentage change from moving average for preceding 5 days (16)..	---	---	---	---	- .0012	- .0001	.0013	---	---	---
Butter futures price, as change from preceding day (18)	.4855	.9793	.2847	.7097	.5811	.5654	.4202	.3453	.5329	.1206
Deviation between futures market and cash market, plus estimated cost of storage (20)	---	---	---	---	- .0075	.0182	- .0414	.1798	- .1420	.0021
Standard error of estimate for equation for estimating daily price change from factors as indicated by coefficients above	±1.217	±1.736	± .440	±1.099	± .660	± .764	± .308	± .934	± .849	± .308
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Percentage of variation in daily price change associated with variation in combination of factors as indicated by coefficients above..	15	25	12	17	17	30	15	26	27	22

1/ Numbers in parentheses following descriptions of supply-demand factors refer to list of factors . pp. 26 and 27.

Table 10.--Multiple regression equations: Constants and net coefficients (average amount of increase or decrease in weekly change in price of Grade A butter at Chicago which occurs with each increase of one unit in selected supply-demand factors), standard errors of estimate, and percentage of variation in weekly price change associated with variation in combination of factors, by marketing seasons, 1947, 1948, 1951, and January-March 1952

Item	Marketing seasons									
	Winter out-of-storage				In-storage			Fall out-of-storage		
	1/2/47 to 4/18/47	1/5/48 to 4/16/48	1/2/51 to 4/13/51	12/31/51 to 3/28/52	4/21/47 to 8/22/47	4/19/48 to 9/17/48	4/16/51 to 9/14/51	3/25/47 to 1/2/48	9/20/48 to 12/31/48	9/17/51 to 12/28/51
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
Constant term of multiple regression equation for marketing season	0.0964	-0.4494	-0.3334	-0.7811	0.8135	-0.5890	0.1448	-0.3595	-2.2616	0.5557
Supply-demand factors 1/	Net regression coefficients									
Weekly butter production in Wisconsin, as percentage change from preceding week (2) ...	- .2910	- .0830	- .0724	.0151	---	---	---	---	---	---
Annual rate of U. S. butter production, as percentage change from annual rate for preceding week (3)	---	---	---	---	.0797	- .0046	- .0636	- .2347	- .0251	- .0777
Five-day moving average of receipts at Chicago, as percentage change from moving average for preceding 5 days (5)	---	---	---	---	- .0364	- .0297	- .0107	---	---	---
Weekly cold storage holdings in 35 markets, as percentage change from holdings for preceding week (7)	---	---	---	---	.0228	.0420	- .0184	- .0400	- .2305	- .0302

See footnote at end of table.

Continued-

Table 10.--Multiple regression equations: Constants and net coefficients (average amount of increase or decrease in weekly change in price of Grade A butter at Chicago which occurs with each increase of one unit in selected supply-demand factors), standard errors of estimate, and percentage of variation in weekly price change associated with variation in combination of factors, by marketing seasons, 1947, 1948, 1951, and January-March 1952--Continued

Item	Marketing seasons									
	Winter out-of-storage				In-storage			Fall out-of-storage		
	1/2/47 to 4/18/47	1/5/48 to 4/16/48	1/2/51 to 4/13/51	12/31/51 to 3/28/52	4/21/47 to 8/22/47	4/19/48 to 9/17/48	4/16/51 to 9/14/51	8/25/47 to 1/2/48	9/20/48 to 12/31/48	9/17/51 to 12/28/51
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
Supply-demand factors 1/	Net regression coefficients									
Five-day moving average of dealers' floor stocks at Chicago, as percentage change from moving average for preceding 5 days (12) ..	-0.1233	-0.0593	-0.0228	-0.2737	-0.0962	-0.1175	-0.0456	-0.1732	-0.0954	-0.0196
Weekly movement into retail channels at Chicago, as percentage change from 4-week moving average (14)	- .0235	.1235	.0173	- .3504	---	---	---	- .0117	- .0421	.0880
Five-day moving average of trade output at Chicago, as percentage change from moving average for preceding 5 days (17)	- .0203	- .0155	- .0090	- .0058	---	---	---	.0240	.0560	.0003
Standard error of estimate for equation for estimating weekly price change from factors as indicated by coefficients above ..	±3.296	±3.692	±1.069	± .536	±1.709	±2.109	± .713	±2.439	±2.232	±1.949
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Percentage of variation in weekly price change associated with variation in combination of factors as indicated by coefficients above	26	7	7	69	20	28	26	49	31	51

1/ Numbers in parentheses following descriptions of supply-demand factors refer to list of factors on pp. 26 and 27.

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☆ U. S. GOVERNMENT PRINTING OFFICE : 1957 O - 437061